INSTALLATION, COMMISSIONING AND SERVICING INSTRUCTIONS

WALL HUNG RSF GAS FIRED CONDENSING BOILER

GREENSTAR i SYSTEM

FOR SEALED CENTRAL HEATING SYSTEMS AND INDIRECTLY FED DOMESTIC HOT WATER

6720643356-00 1Wo

The appliance is for use with Natural Gas or L.P.G. (Cat II 2H3P type C13, C33 & C53)		
	Model	**GC Number**
Natural Gas	12i System	41-311-67
	15i System	41-311-84
	18i System	41-311-86
	24i System	41-311-68
Liquid Petroleum Gas	12i System	41-311-69
	15i System	41-311-85
	18i System	41-311-87
	24i System	41-311-70

UK/IE

benchmark COLLECTIVE MARK
THE MARK OF QUALITY FOR THE INSTALLATION, COMMISSIONING AND SERVICING OF DOMESTIC HEATING AND HOT WATER SYSTEMS

WORCESTER
Bosch Group

6720644743b (2011/08)

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1 KEY TO SYMBOLS AND SAFETY PRECAUTIONS

1.1 EXPLANATION OF SYMBOLS

WARNING SYMBOLS

Safety instructions in this document are framed and identified by a warning triangle which is printed on a grey background.

Electrical hazards are identified by a lightning symbol surrounded by a warning triangle.

Signal words indicate the seriousness of the hazard in terms of the consequences of not following the safety instructions.

- **NOTICE** indicates possible damage to property or equipment, but where there is no risk of injury.
- **CAUTION** indicates possible injury.
- **WARNING** indicates possible severe injury.
- **DANGER** indicates possible risk to life.

IMPORTANT INFORMATION

Notes contain important information in cases where there is no risk of personal injury or material losses and are identified by the symbol shown on the left. They are bordered by horizontal lines above and below the text.

ADDITIONAL SYMBOLS

Symbol	Meaning
▸	a step in an action sequence
→	a reference to a related part in the document or to other related documents
•	a list entry
–	a list entry (second level)

Tab. 1 Symbols

SYMBOLS USED IN THIS MANUAL

	Domestic Hot Water
	Central Heating
	Hot Water Storage Cylinder
	Domestic Cold Water Supply
	Electrical Supply
	Gas Supply

Tab. 2 Commonly used symbols

PLEASE READ THESE INSTRUCTIONS CAREFULLY BEFORE STARTING INSTALLATION.

THESE INSTRUCTIONS ARE APPLICABLE TO THE WORCESTER APPLIANCE MODEL(S) STATED ON THE FRONT COVER OF THIS MANUAL ONLY AND MUST NOT BE USED WITH ANY OTHER MAKE OR MODEL OF APPLIANCE.

THE INSTRUCTIONS APPLY IN THE UK ONLY AND MUST BE FOLLOWED EXCEPT FOR ANY STATUTORY OBLIGATION.

THIS APPLIANCE MUST BE INSTALLED BY A GAS SAFE REGISTERED, COMPETENT PERSON. FAILURE TO INSTALL CORRECTLY COULD LEAD TO PROSECUTION.

IF YOU ARE IN ANY DOUBT CONTACT THE WORCESTER TECHNICAL HELPLINE.

DISTANCE LEARNING AND TRAINING COURSES ARE AVAILABLE FROM WORCESTER.

PLEASE LEAVE THESE INSTRUCTIONS WITH THE COMPLETED BENCHMARK CHECKLIST, (OR A CERTIFICATE CONFIRMING COMPLIANCE WITH IS 813, EIRE ONLY) AND THE USER MANUAL WITH THE OWNER OR AT THE GAS METER AFTER INSTALLATION OR SERVICING.

THE BENCHMARK CHECKLIST CAN BE FOUND IN THE BACK PAGES OF THE INSTALLATION MANUAL.

ABBREVIATIONS USED IN THIS MANUAL:

Ø	Diameter
NG	Natural Gas
LPG	Liquid Petroleum Gas
CH	Central Heating
DHW	Domestic Hot Water
PRV	Pressure Relief Valve
NTC	Negative Temperature Coefficient (sensor)
IP	Ingress Protection
RCD	Residual Current Device
TRV	Thermostatic Radiator Valve
WRAS	Water Regulations Advisory Scheme
SEDBUK	Seasonal Efficiency of Domestic Boilers in the United Kingdom

Tab. 3 Abbreviations

1.2 SAFETY PRECAUTIONS

IF YOU SMELL GAS:

- **CALL** NATIONAL GAS EMERGENCY SERVICE ON 0800 111 999
- **LPG BOILERS** CALL THE SUPPLIER'S NUMBER ON THE SIDE OF THE LPG TANK
- **TURN OFF** THE ECV (EMERGENCY CONTROL VALVE) AT THE METER/REGULATOR
- **DO NOT** TURN ELECTRICAL SWITCHES ON OR OFF
- **DO NOT** STRIKE MATCHES OR SMOKE
- PUT OUT NAKED FLAMES
- OPEN DOORS AND WINDOWS
- KEEP PEOPLE AWAY FROM THE AFFECTED AREA

BOILER OPERATION:

This boiler must only be operated by a responsible adult who has been instructed in, understands, and is aware of the boiler's operating conditions and effects.

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LICENSED INSTALLER FOR THE INSTALLATION, COMMISSIONING AND SERVICING OF DOMESTIC HEATING AND HOT WATER SYSTEMS
www.centralheating.co.uk

Benchmark places responsibilities on both manufacturers and installers. The purpose is to ensure that customers are provided with the correct equipment for their needs, that it is installed, commissioned and serviced in accordance with the manufacturer's instructions by competent persons and that it meets the requirements of the appropriate Building Regulations. The Benchmark Checklist can be used to demonstrate compliance with Building Regulations and should be provided to the customer for future reference.

Installers are required to carry out installation, commissioning and servicing work in accordance with the Benchmark Code of Practice which is available from the Heating and Hotwater Industry Council who manage and promote the scheme.
Visit **centralheating.co.uk** for more information.

HEALTH AND SAFETY

The appliance contains no asbestos and no substances have been used in the construction process that contravene the COSHH Regulations (Control of Substances Hazardous to Health Regulations 1988).

COMBUSTION AND CORROSIVE MATERIALS

Do not store or use any combustible materials (paper, thinners, paints etc.) inside or within the vicinity of the appliance.

Chemically aggressive substances can corrode the appliance and invalidate any warranty.

FITTING AND MODIFICATIONS

Fitting the appliance and any controls to the appliance may only be carried out by a competent engineer in accordance with the current Gas Safety (Installation and Use) Regulations.

Flue systems must not be modified in any way other than as described in the fitting instructions. Any misuse or unauthorised modifications to the appliance, flue or associated components and systems could invalidate the warranty. The manufacturer accepts no liability arising from any such actions, excluding statutory rights.

SERVICING

Advise the user to have the system serviced annually by a competent, qualified Gas Safe registered engineer. Approved spares must be used to help maintain the economy, safety and reliability of the appliance.

IMPORTANT

The service engineer must complete the Service Record on the Benchmark Checklist after each service.

INSTALLATION REGULATIONS

Current Gas Safety (Installation & Use) Regulations:

All gas appliances must be installed by a competent person in accordance with the above regulations. Failure to install appliances correctly could lead to prosecution.

The appliance must be installed in accordance with, and comply to, the current: Gas Safety Regulations, IEE Regulations, Building Regulations, Building Standards (Scotland) (Consolidation), Building Regulations (Northern Ireland), local water by-laws, Health & Safety Document 635 (The Electricity at Work Regulations 1989) and any other local requirements.

British Standards:

Where no specific instruction is given, reference should be made to the relevant British Standard codes of Practice.

BS7074:1 Code of practice for domestic and hot water supply

BS6891 Installation of low pressure gas pipe work up to 28mm (R1)

BS5546 Installation of gas hot water supplies for domestic purposes

EN12828 Central heating for domestic premises

BS5440:1 Flues and ventilation for gas appliances of rated heating not exceeding 70kW (net) : Flues

BS5440:2 Flues and ventilation for gas appliances of rated heating not exceeding 70kW (net) : Air Supply

BS7593 Treatment of water in domestic hot water central heating systems

BS6798 Installation of gas fired boilers of rated input up to 70kW (net)

Irish Standards

The relevant Irish standards should be followed, including:

- ECTI National rules for electrical installations
- IS 813:2002 for Domestic Gas Installations.

LPG Installations

An appliance using L.P.G. must not be installed in a room or internal space below ground level unless one side of the building is open to the ground.

Timber framed building:

Where the boiler is to be fitted to a timber framed building the guidelines laid down in BS5440: Part 1 and IGE "Gas Installations in Timber Frame Buildings" should be adhered to.

Potable water:

All seals, joints and compounds (including flux and solder) and components used as part of the secondary domestic water system must be approved by WRAS.

CH Water:

Artificially softened water must not be used to fill the central heating system.

BOILER FEATURES AND CHECKLIST

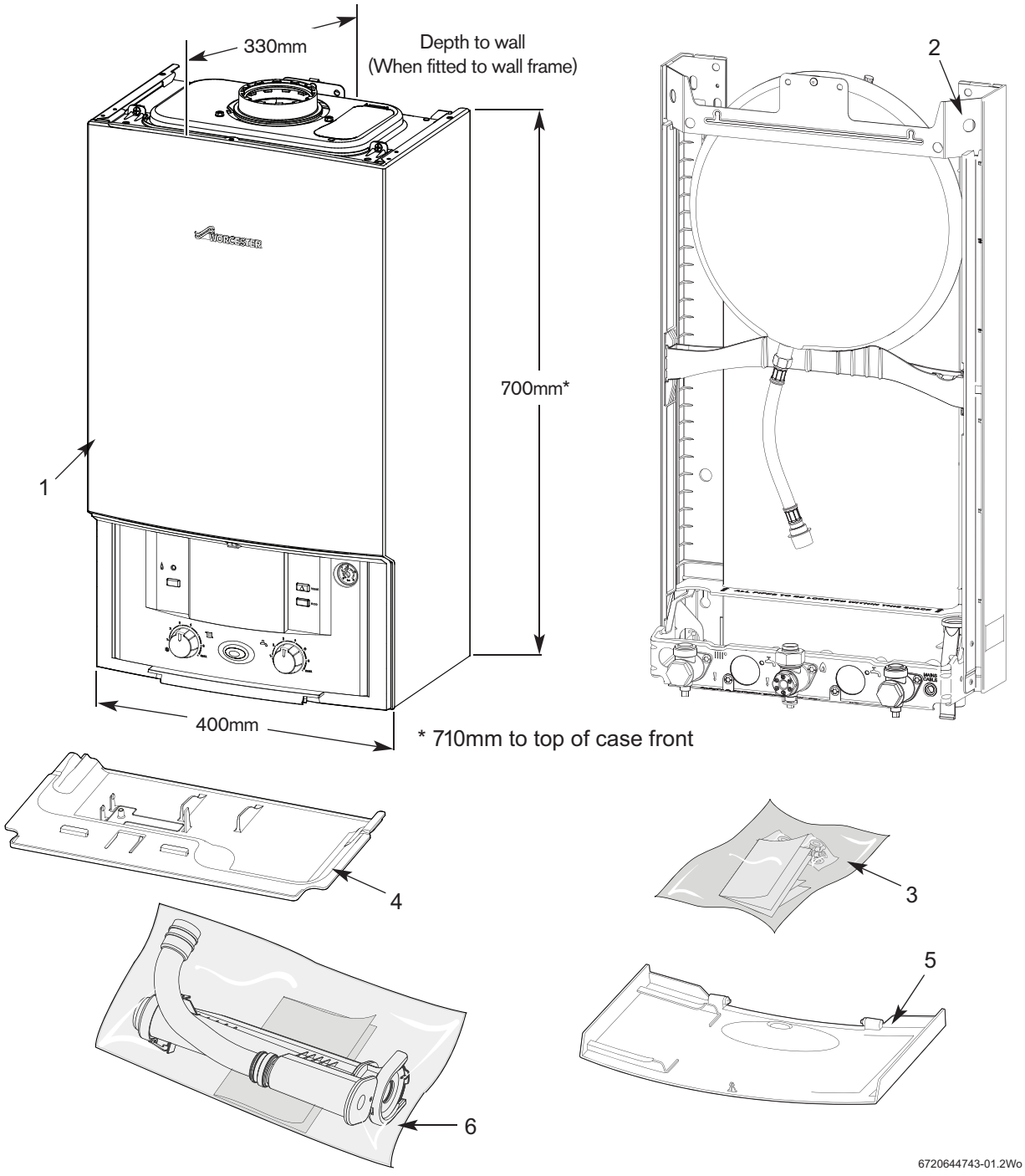
- Pre-wired and pre-plumbed
- Galvanised steel inner frame
- Digital control system
- FX Intelligent controls
- Low NOx option
- Automatic ignition
- Direct burner ignition electrodes
- Built-in frost protection
- Built-in fault finding diagnostics
- Modulating automatic gas valve
- Combustion air fan with speed regulator
- CH temperature sensor & control
- Pump anti-seizure protection
- Flue gas temperature sensor
- Condensate syphonic trap
- Temperature control

CHECK LIST	
- HARDWARE LITERATURE PACK:	**Qty.**
Greenstar 12i/15i/18i & 24i System Installation, Commissioning and Servicing Instructions	1
Users Instructions	1
Consumer Guarantee Card	1
Sealing Pack:	1
- Compression Nut 22mm	3
- Compression Ring 22mm	3
- Compression Nut 15mm	3
- Compression Ring 15mm	3
- Fibre Washer 18.6 x 13.5 x 1.5	2
- Fibre Washer 23.9 x 17.2 x 1.5	2
- Bonded Washer 3/4“ for gas	1
Syphon assembly	1
- Installation instructions	1
Warranty Return Envelope	1

Tab. 4 Hardware lit pack - checklist

2 APPLIANCE INFORMATION

2.1 APPLIANCE



STANDARD PACKAGE:	
1	Wall hung gas fired condensing system boiler for central heating and hot water
2	Wall mounting frame
3	Hardware literature pack (see checklist)
4	Bottom Panel
5	Fascia panel
6	Syphon assembly

Tab. 5

2.2 TECHNICAL DATA

DESCRIPTION		NATURAL GAS				LPG			
	UNIT	12i	15i	18i	24i	12i	15i	18i	24i
Gas flow rate - Max. 10 minutes from lighting									
Natural Gas G20	m³/h	1.33	1.63	1.96	2.67	-	-	-	-
Propane Gas (LPG)	kg/h	-	-	-	-	0.96	1.20	1.44	1.91
Central Heating									
Maximum rated heat input (net)	kW	12.32	15.40	18.48	24.62	12.32	15.40	18.48	24.62
Minimum heat input	kW	3.45	4.62	5.54	7.38	5.95	5.95	9.64	9.64
Max. rated heat output 40/30 °C	kW	12.85	16.06	19.28	25.67	12.85	16.06	19.28	25.67
Max. rated heat output 50/30 °C	kW	12.74	15.92	19.11	25.45	12.74	15.92	19.11	25.45
Max. rated heat output 80/60 °C	kW	12	15	18	24	12	15	18	24
Max. flow temperature	°C	82	82	82	82	82	82	82	82
Max. flow temperature to cylinder (with integral optional diverter valve)	°C	75	75	75	75	75	75	75	75
Max. permissible operating pressure	bar	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Available pump head at 21 °C system temp. rise	m	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Flue									
Flue gas temp. 80/60 °C, rated/min. load	°C	62/56	66/58	70/60	78/63	62/57	66/59	71/61	79/64
Flue gas temp. 40/30 °C, rated/min. load	°C	41/33	44/33	48/34	54/35	43/35	46/36	49/37	55/38
CO_2 level at max. rated heat output (after 30 min)	%	9.65	9.8	9.8	9.8	11.0	11.0	11.0	11.0
CO_2 level at min. rated heat output (after 30 min)	%	8.65	9.2	9.2	9.2	10.5	10.5	10.5	10.5
NOx class		5	5	4	5	5	5	4	5
NOx rating	mg/kWh	39	60	84	66	44	60	84	66
Condensate									
Maximum condensate rate	l/h	0.93	1.2	1.5	2.0	0.7	0.9	1.2	1.5
pH value, approx.		4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Electrical									
Electrical power supply voltage	a.c. V	230	230	230	230	230	230	230	230
Frequency	Hz	50	50	50	50	50	50	50	50
Maximum power consumption	W	140	140	140	140	140	140	140	140
General data									
SEDBUK	band	A	A	A	A	A	A	A	A
Appliance protection rating	IP	X4D	X4D	X4D	X4D	X4D	X4D	X4D	X4D
Appliance protection rating with mechanical or RF mechanical timer or FW100 module fitted	IP	20	20	20	20	20	20	20	20
Permissible ambient temperatures	°C	0 - 50	0 - 50	0 - 50	0 - 50	0 - 50	0 - 50	0 - 50	0 - 50
Nominal capacity of appliance	litre	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Noise output level (Max central heating)	dBA	42	42	42	42	42	42	42	42
Packaged boiler weight	kg	41	41	41	41	41	41	41	41
Total boiler weight	kg	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Lift weight	kg	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1
SEDBUK	%	90.1	90.1	90.1	90.1	91.4	91.4	91.4	92.0

Tab. 6 Technical data i System

2.3 LAYOUT

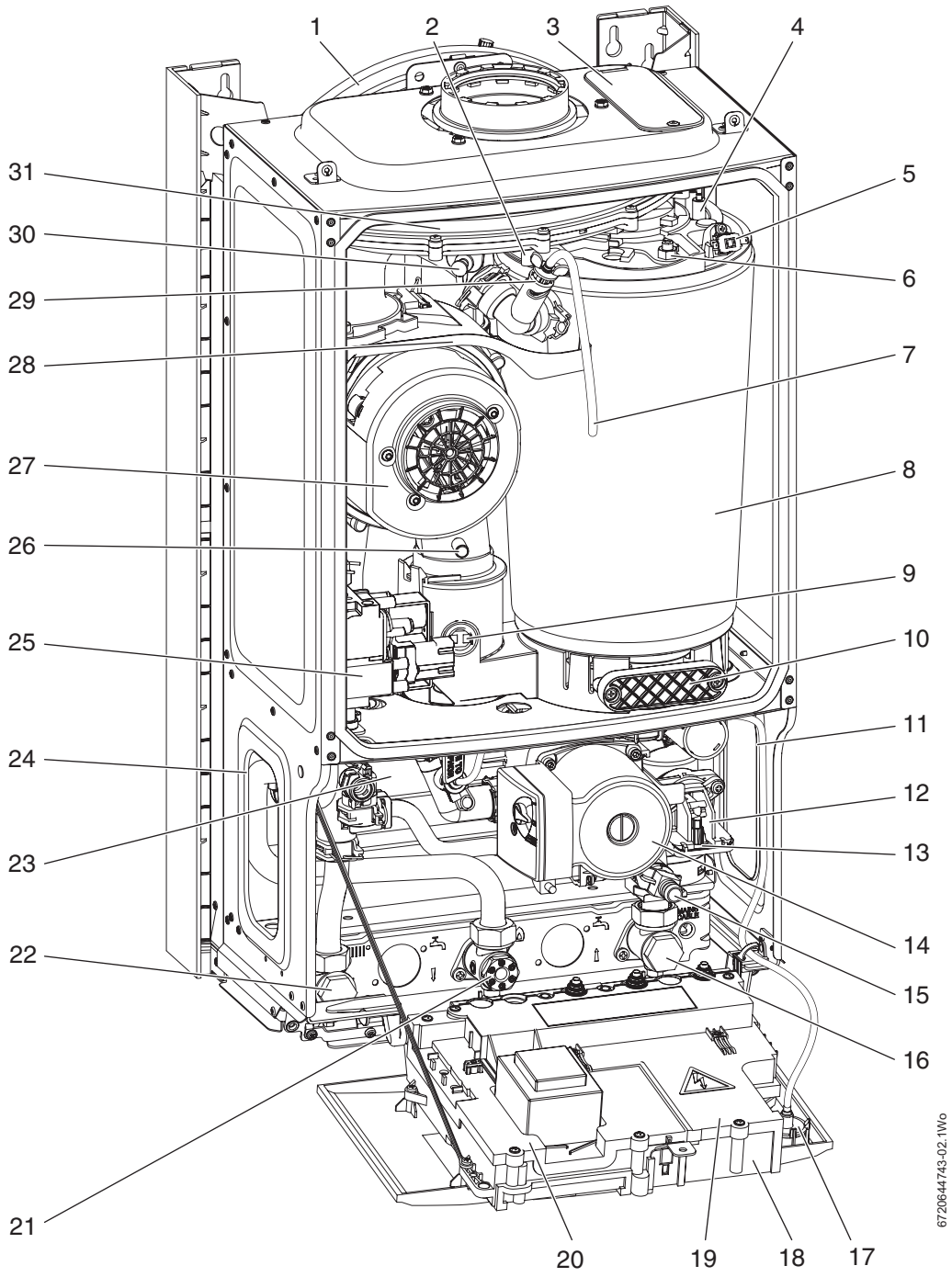


Fig. 1 Main boiler components

1	Expansion Vessel	23	Hydraulic block mounting plate
2	Sensor - Boiler flow	24	Left side hand-hold for lifting boiler
3	Removable panel - for servicing	25	Gas valve
4	Electrode assembly	26	Flue air pressure switch connection (not used)
5	Overheat thermostat	27	Fan
6	Securing nut - Air/Gas manifold clamp	28	Fan guard
7	Silicon tube - heat exchanger air vent	29	Manual vent point
8	Heat exchanger	30	Fan pressure test point
9	Flue over heat thermostat	31	Air/Gas manifold
10	Access panel - Heat exchanger/sump cleaning	32	Compact hydraulic - left mounting point
11	Right side hand-hold for lifting boiler	33	Flow connector from heat exchanger
12	Diverter valve assembly (body)	34	Expansion vessel hose connection point
13	Diverter valve actuator (stepper motor blank)	35	Auto air vent
14	Pump	36	Return connection to heat exchanger
15	Drain point	37	Flow turbine housing (not used on i System)
16	Central Heating (CH) return isolator	38	Unused port
17	System pressure gauge	39	Compact hydraulic - right mounting point
18	Control panel (in service position)	40	Pressure relief valve
19	Cover - external wiring connections	41	CH return connection to service valve
20	Cover - transformer and PCB	42	Internal by-pass
21	Gas inlet connection 22 mm	43	CH flow connection to service valve
22	Central Heating (CH) flow isolator	44	Pressure gauge connection point

Tab. 7 Boiler components

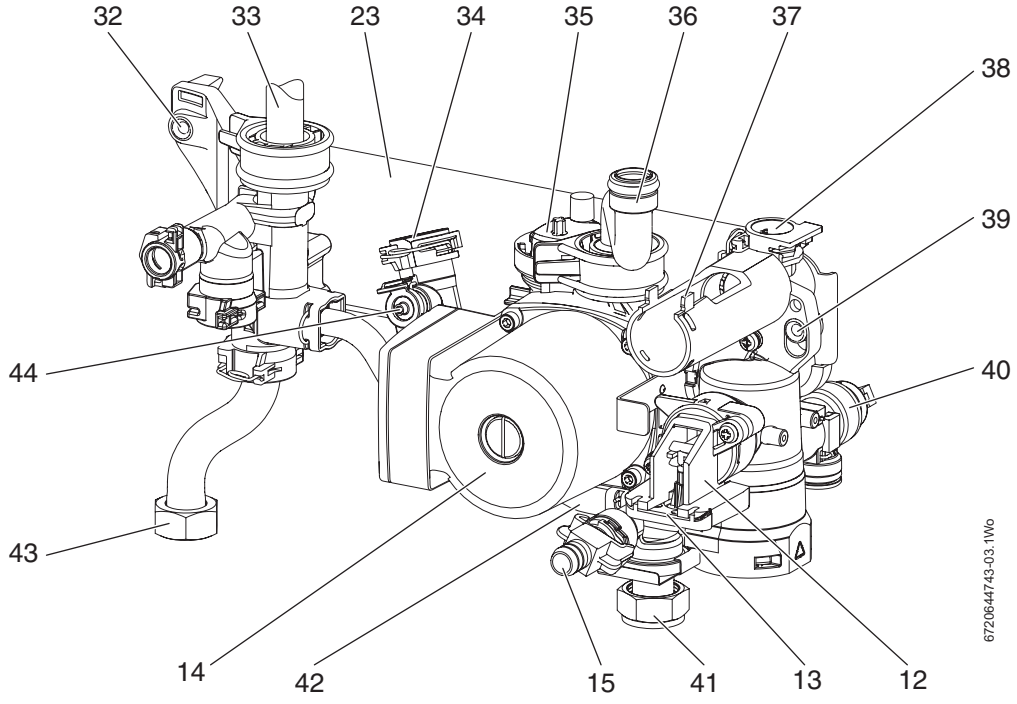


Fig. 2 Hydraulic block components

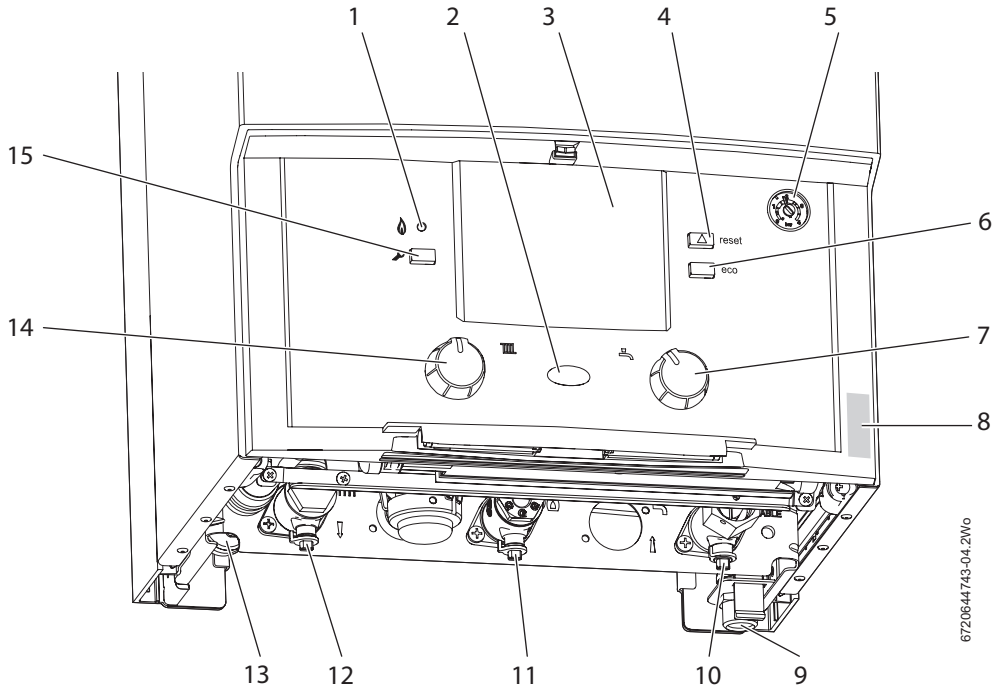


Fig. 3 Additional components

1	Burner ON indicator light (green)	9	PRV pipe connection point
2	Power ON/OFF indicator/fault diagnostic light (blue)	10	CH return isolator
3	Position for optional programmer	11	Gas inlet connection 22 mm
4	Reset button	12	CH flow isolator
5	System pressure gauge	13	Condensate connection
6	ECO button (not used)	14	CH temperature control
7	DHW temperature control*	15	Service mode button
8	Boiler identification label		

Tab. 8 Additional boiler components

* The DHW temperature control is only operational when the “Optional Internal Diverter Valve” is fitted.

3 PRE-INSTALLATION

3.1 CLEANING PRIMARY SYSTEMS

NOTICE:

- All the following Pre-Installation sections must be read and requirements met before starting boiler or flue installations.

CAUTION:

- ISOLATE THE MAINS SUPPLIES BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

NOTICE:

Debris from the system can damage the boiler and reduce efficiency.
Failure to comply with the guidelines for the use of water treatment with the appliance will invalidate the appliance warranty.

BEFORE CLEANING THE SYSTEM:

- **Ensure that the system and pipe work is in good working order.**
- **Where possible keep the existing boiler/circulating pump in place when flushing the system.**

FOLLOW THE GUIDANCE OF BS7593:

Treatment of water in domestic hot water central heating and also the flushing guidelines below.

NOTICE: ARTIFICALLY SOFTENED WATER MUST NOT BE USED TO FILL THE CENTRAL HEATING SYSTEM.

FLUSHING THE SYSTEM

- Fill the system with cold water and check for leaks.
- Open all drain cocks and drain the system.
- Close drain cocks and add a suitable flushing agent **compatible with aluminium** at the correct strength for the system conditions in accordance with the manufacturer‘s instructions.
  The pH value of the system water must be less than 8 or the appliance guarantee will be invalidated.
- Circulate the flushing agent before the boiler is fired up.
- Run the boiler/system at normal operating temperature as directed by the manufacturer of the flushing agent.
- Drain and thoroughly flush the system to remove the flushing agent and debris.
- It may be necessary to use a power flushing machine to aid the cleansing procedure in some circumstances.
- Close the drain cocks and refill with fresh water and a suitable inhibitor.
- Vent any air from the boiler and system.

INHIBITOR

Add a suitable inhibitor or combined inhibitor/anti-freeze, if the system is exposed to freezing conditions, to the heating system in accordance with the DWTA code of practice and manufacturer‘s guidelines.

WARNING: Sealing agents

- The addition of sealing agents to the system water is not permitted as this can cause problems with deposits left in the heat exchanger.

3.2 MAINS SUPPLY

3.2.1 ELECTRICAL SUPPLY

- Supply: 230V - 50 Hz, 140 Watts
- Cable: PVC insulated 0.75 mm^2 (24 x 0.2 mm) temperature rated to 90 °C.
- External 3A fuse to BS1362.
- The appliance must be earthed.
- This appliance must not be connected to a three phase supply.
- IPX4D.

NOTICE: This is reduced to IP20 if the following mechanical timers are fitted; 7 716 192 036 or 7 716 192 037 or the FW100 controller 7 716 192 067.

- Wiring must comply with the latest edition of BS 7671 (IEE wiring regulations).

3.2.2 GAS SUPPLY

- Boilers using Natural Gas (NG) must be connected to a governed meter.
- Liquid Petroleum Gas (LPG) must be connected to a regulator.
- Installation and connection of the gas supply to the boiler must be in accordance with BS6891.
- Under no circumstance should be size of the gas supply pipe be less than 22 mm.
- The meter or regulator and pipe work to the meter must be checked, preferably by the gas supplier. This is to ensure that the equipment is in good working order and can meet the gas flow and pressure requirements, in addition to the demand from any other appliance being served.

3.3 WATER SYSTEM AND PIPE WORK

PLASTIC PIPE WORK:

- Any plastic pipe work must have a polymeric barrier with 600mm (minimum) length of copper pipe connected to the boiler.
- Plastic pipe work used for underfloor heating must be correctly controlled with a thermostatic blending valve limiting the temperature of the circuits to approximately 50 °C.

PRIMARY SYSTEMS CONNECTIONS/VALVES:

- All system connections, taps and mixing valves must be capable of sustaining a pressure up to 3 bar.
- Radiator valves should conform to BS2767:10.
- All other valves should conform to BS1010.
- Thermostatic radiator valves (TRV's) must be used on all radiators within the sleeping accommodation but not the radiator where the room thermostat is sited. This must be fitted with lock-shield valves and left open.
- A drain cock is required at the lowest point in the system.
- An air vent is required at all the high points in the system.

The boiler is equipped with an automatic internal by-pass.

SEALED PRIMARY SYSTEM:

NOTICE: Artificially softened water must not be used to fill the central heating system.

- The CH sealed system must be filled using a WRAS approved filling loop or comply with figure 4 for system fill.
- Where the system volume is more than 100 litres or exceeds 2.65 bar at maximum heating temperature, an extra expansion vessel (2) must be fitted as close as possible to the appliance in the central heating return.
- Pressurise the extra expansion vessel (2) to the same figure as the expansion vessel built into the appliance.
- **Do not use galvanised pipes or radiators**.

SYSTEM FILL

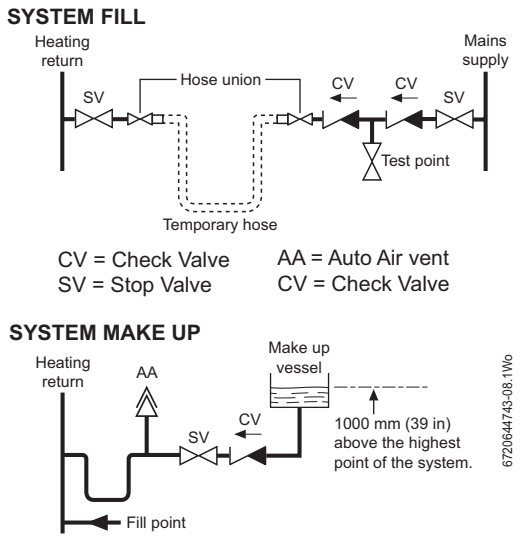


Fig. 4 System fill

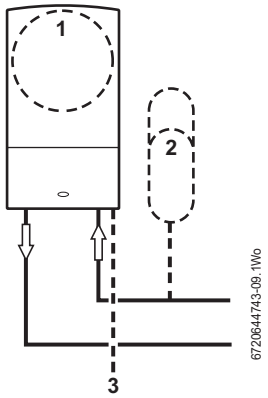


Fig. 5 Additional expansion vessel

1	Appliance expansion vessel - CH
2	Extra expansion vessel - CH return
3	Pressure relief discharge

Tab. 9 Key to fig. 5

EXISTING BUILDS: S AND Y PLAN SYSTEMS:

NOTICE: The boiler is fitted with its own internal bypass.

1	Diverter/Zone valve
2	Radiator valve (flow)
3	Lock shield valve (return)
4	Bypass

Tab. 10

S PLAN LAYOUT

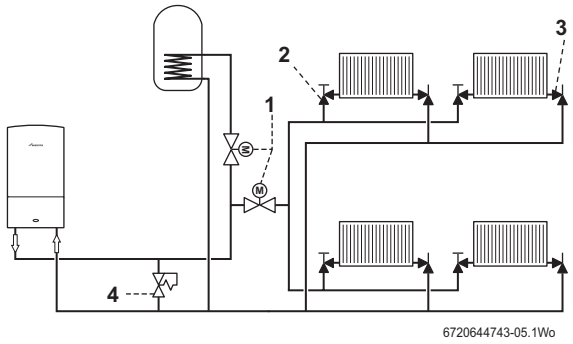


Fig. 6 Existing build - S Plan

Y PLAN LAYOUT WITH EXTERNAL DIVERTER VALVE

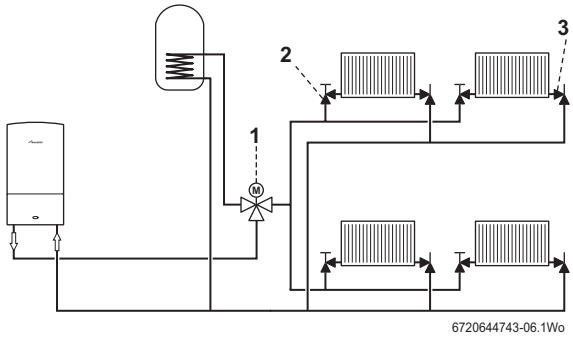


Fig. 7 Existing build - Y Plan external diverter valve

NOTICE:

- A drain cock should be fitted at the lowest point of the heating circuit and beneath the appliance.

OPTIONAL DIVERTER VALVE

This boiler is designed to operate on a sealed system only. The boiler will require a second return pipe from the water cylinder to the wall mounting frame and terminate in 15mm copper pipe.

EXISTING BUILD - SYSTEM LAYOUT WITH OPTIONAL INTERNAL DIVERTER VALVE (NOT SUPPLIED WITH BOILER)

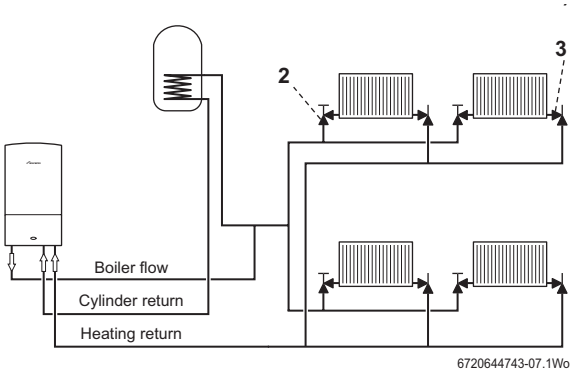


Fig. 8 Existing build - Internal diverter valve

NEW BUILD - TWO ZONED HEATING SYSTEM

The latest Part L1a regulation for new installations require separate zone controls for the central heating.

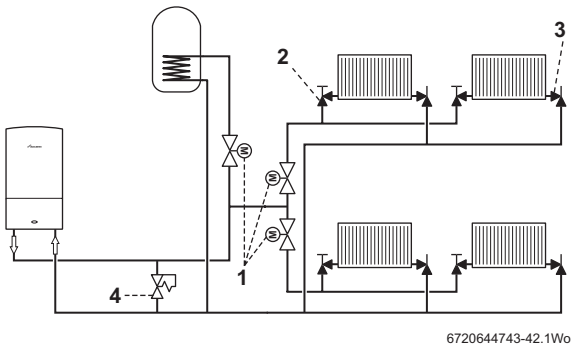


Fig. 9 New build - System layout

3.4 CONDENSATE PIPE WORK

NOTICE:

- Where a new or replacement boiler is being installed, access to an internal “gravity discharge” point should be one of the factors considered in determining boiler location.
- The condensate pipe must be nominally 22mm Ø plastic pipe.
- The condensate pipe work must fall at least 52mm per metre towards the outlet and should take the shortest practicable route.
- Ensure there are no blockages in the pipe run.

Key to condensate illustrations	
1	Condensate discharge from boiler
2	Soil and vent stack
3	Minimum 450mm and up to three storeys
4	Visible air break at plug hole
5	Sink or basin with integrated overflow
6	75mm sink waste trap
7	Condensate pump
*	Condensate trap of 75mm already incorporated into the boiler

Tab. 11

3.4.1 INTERNAL CONNECTIONS

In order to minimise risk of freezing during prolonged cold spells, the following methods of installing condensate drainage pipe should be adopted, in order of priority.

Wherever possible, the condensate drainage pipe should be routed and terminated so that the condensate drains away from the boiler under gravity to a suitable internal foul water discharge point such as an internal soil and vent stack. A suitable permanent connection to the foul waste pipe should be used.

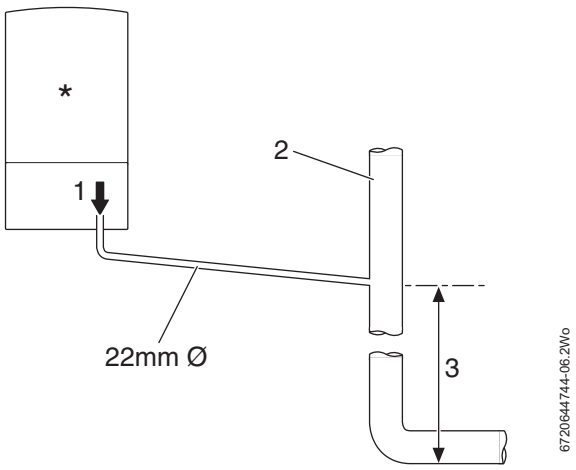


Fig. 10 Disposal to soil vent stack

Alternatively if the first option is not possible an internal kitchen or bathroom waste pipe, washing machine waste pipe etc. can be used.
Ensure that the condensate drain pipe is connected “down stream” of the waste trap.

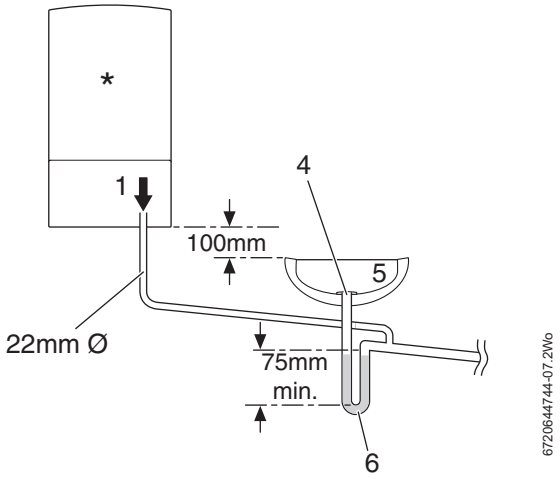


Fig. 11 Disposal to a waste pipe

CONDENSATE PUMP

Where “gravity discharge” to an internal termination is not physically possible, or where very long internal runs would be required to reach a suitable discharge point, condensate should be removed using a proprietary condensate pump, of a specification recommended by the boiler or condensate pump manufacturer.

The pump outlet pipe should discharge to a suitable internal foul water discharge point such as an internal soil and vent stack, internal kitchen or bathroom waste pipe, washing machine waste pipe etc. A suitable permanent connection to the foul waste pipe should be used.

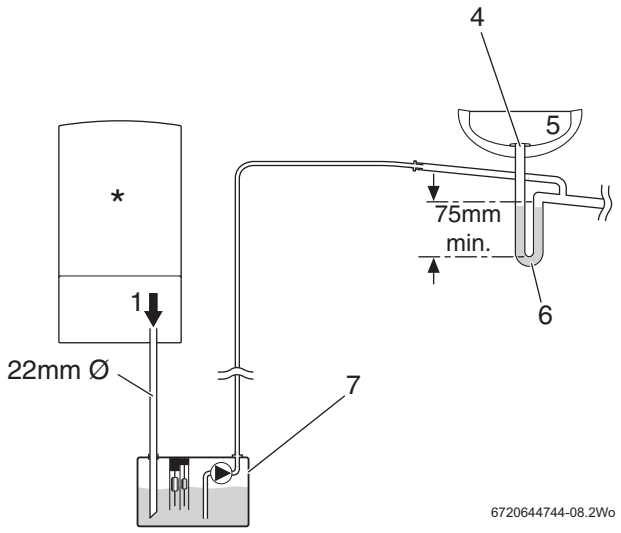


Fig. 12 Condensate pump disposal

3.4.2 EXTERNAL CONNECTIONS

NOTICE: Freezing conditions

- Pipe work length should be kept to a minimum and the route as vertical as possible.
- Weather proof insulation must be used.

NOTICE: Condensate waste

- Care should be taken when siting a soak-away to avoid obstructing existing services.

Continued - Key to condensate illustrations	
8	PVCu strap on fitting
9	100mm Ø minimum plastic pipe
10	Drainage holes
11	Limestone chippings
12	Bottom of sealed tube
13	Insulate and increase pipe size
14	Pipe work transition
15	External air break
16	Air gap
17	External rain water pipe into foul water
18	43mm 90° male/female bend
*	Condensate trap of 75mm already incorporated into the boiler

Tab. 12

If no other discharge method is possible then the use of an externally run condensate drainage pipe terminating at a suitable foul water discharge point, or purpose-designed soak away, may be considered. If this method is chosen then the following measures should be adopted:

- The external run be kept as short as possible and not exceed three metres.
- The pipe should be run internally as far as possible before going externally and the pipe diameter should be increased to 32mm before it passes through the wall to the exterior. The pipe should be insulated using suitable waterproof and weather resistant insulation.
- The external pipe should take the shortest and least exposed route to the discharge point, and should "fall" as steeply as possible away from the boiler, with no horizontal runs in which condensate might stand.
- The use of fittings, elbows etc. should be kept to a minimum and any internal “burrs” on cut pipe work should be removed so that the internal pipe section is as smooth as possible.

FITTING AN EXTERNAL AIR BREAK

- Refer to figure 13 when a rain water down pipe is used to dispose of condensate.
- An air break must be installed in the 43mm pipe work, between the boiler condensate outlet and the drainpipe, outside the property, to avoid flooding during adverse weather conditions.

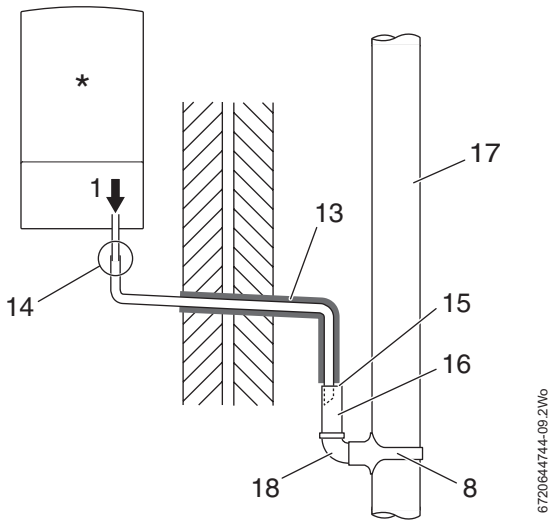


Fig. 13 Disposal into a rainwater down pipe

Condensate drainage pipe can be run above or below ground.

Where the pipe terminates over an open drain or gully, the pipe should terminate below the grating level, but above water level, in order to minimise “wind chill” at the open end.

The use of a drain cover (such as those used to prevent blockage by leaves) may offer further protection from wind chill.

Pipe drainage will be improved if the end is cut at 45° as opposed to a straight cut.

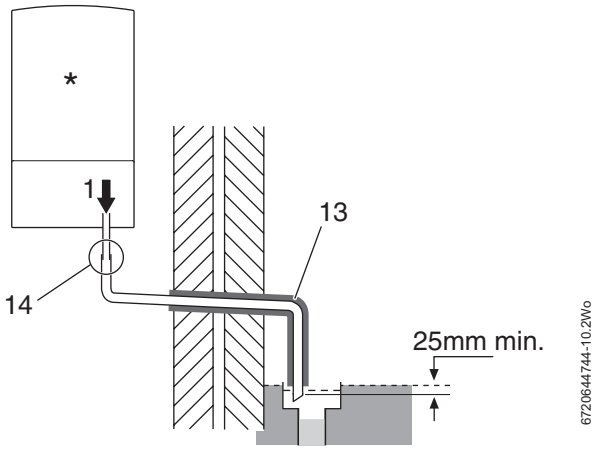


Fig. 14 External disposal

CONDENSATE SOAK AWAY

- The condensate drainage pipe may be run above or below the ground to the soak away. The examples shown on this page run above ground.
- The soak away must use a 100mm Ø plastic tube with two rows of three 12mm holes on 25mm centres and 50mm from the bottom of the tube. The holes must face away from the house.
- The tube must be surrounded by at least 100mm of limestone chippings to a depth of 400mm.

Minimum hole size for the condensate soak away must be 400mm deep by 300mmØ .

In situations where there are likely to be extremes of temperature or exposure, the use of a proprietary trace-heating system for external pipe work, incorporating an external frost thermostat, should be considered. If such a system is used, the requirement to use 32mm pipe does not apply. However, all other guidance above and the instructions for the trace heating system, should be closely followed.

NOTICE: Unheated internal areas.

- Internal pipe runs in unheated areas such as lofts, basements and garages should be treated as external runs.

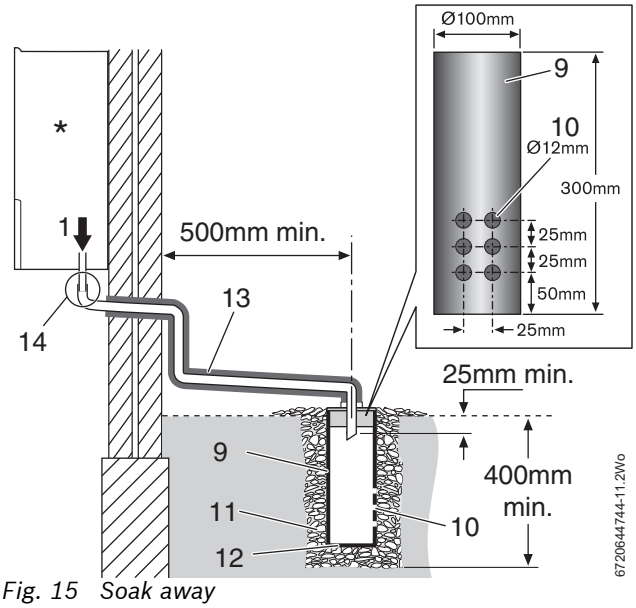


Fig. 15 Soak away

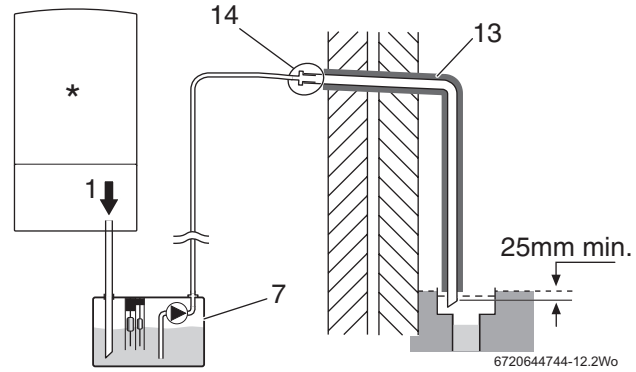


Fig. 16 Condensate pump to external disposal

3.5 PRESSURE RELIEF PIPE WORK

NOTICE:

- The pressure relief valve is a safety device for the boiler and if activated may discharge boiling water steam through the relief valve drain pipe.
- Care should be taken when siting the outlet pipe so that it does not cause an obstruction or discharge above a window, entrance or other public access where it could cause a hazard.

- The pressure relief drain pipe (1) from the boiler should be at least 15mm diameter copper pipe and run downwards, away from any electrical equipment or other hazard, preferably to an external drain or soak away.
- Pipe (1) should be finished with a partial bend, near the outlet to face the external wall (as shown) to help prevent freezing.

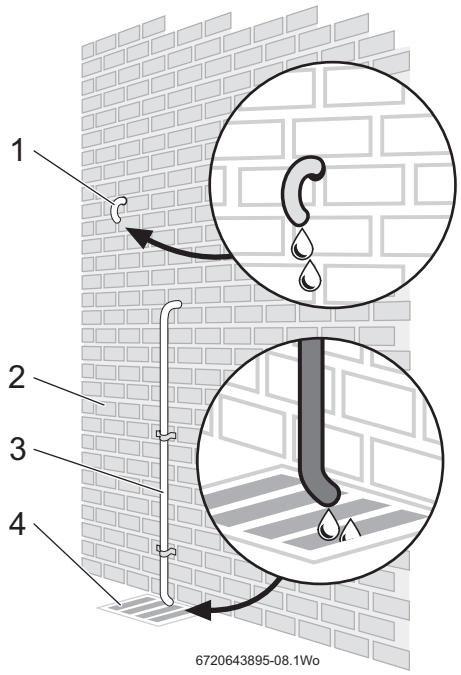


Fig. 17 Pressure relief pipe work

2	Outside wall
1,3	Drain pipe
4	External drain

Tab. 13 Key to fig 7

3.6 BOILER LOCATION AND CLEARANCES

3.6.1 INSTALLATION

This boiler is only suitable for installing internally within a property at a suitable location onto a fixed, rigid surface at least the same size as the boiler and capable of supporting the boiler weight.

NOTICE:
No surface protection is required against heat transfer from the boiler

3.6.2 SERVICING CLEARANCES - VENTILATED COMPARTMENT

Figure 18 shows the minimum space required to install and service the boiler in a ventilated compartment.

- If a boiler is installed in a compartment with clearances less than shown in the tables 16, 17, or 18 ventilation is required. Refer to table 14 for ventilation requirements.

Vent position	To room or internal space	Direct to outside
High level	Minimum free area 122 cm^2	Minimum free area 61 cm^2
Low level	Minimum free area 122 cm^2	Minimum free area 61 cm^2

Tab. 14 Compartment ventilation

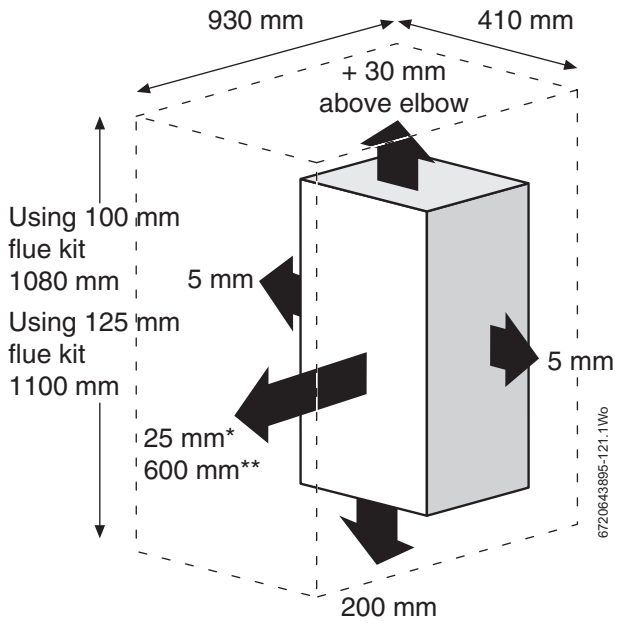


Fig. 18 Ventilated compartment

*	Minimum clearance to removable door
**	Minimum clearance required for servicing

Tab. 15 Minimum clearances

3.6.3 COMPARTMENTS

Follow the requirements of BS6798 and BS5440 Part 2 and note:

- Minimum clearances must be maintained.
- An access door is required to install, service and maintain the boiler and any ancillary equipment.
- If fitting the boiler into an airing cupboard use a non-combustible material to separate the boiler from the airing space.
  The material can be perforated up to a maximum hole size of 13mm.

3.6.4 BATHROOMS

A boiler fitted with a mechanical timer or RF mechanical timer (receiver) or FW100 controller may only be installed outside the shaded area.

A boiler with any other timer fitted (or blanking panel for optional programmer) can be installed in zone 2.

Additional RCD (Residual Current Device) protection may be required.

Refer to the latest IEE wiring regulations.

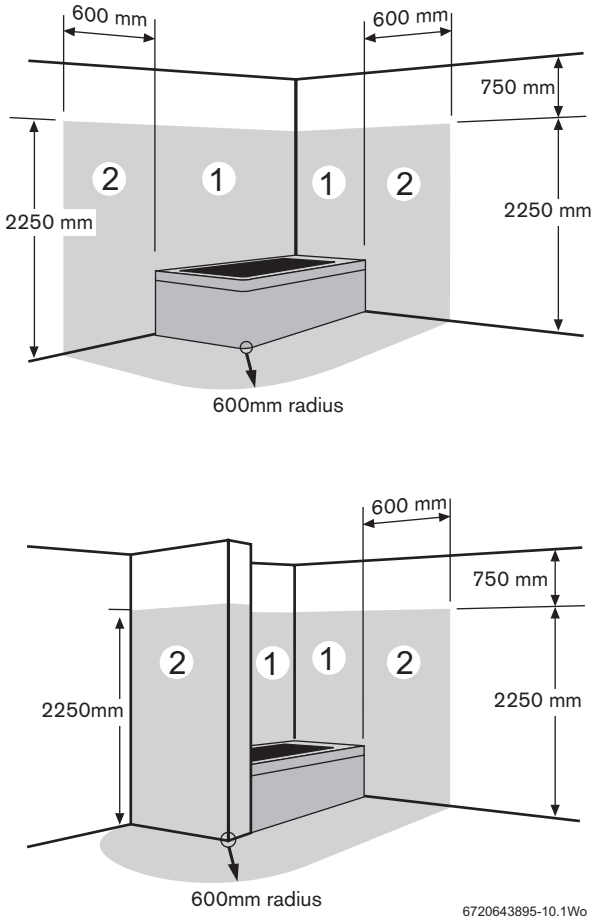


Fig. 19 Bathroom installations

3.6.5 BOILER CLEARANCES - UNVENTILATED COMPARTMENTS

The tables below show the options for the minimum space required to install and service the boiler inside an unventilated compartment.

3.6.6 INSTALLATION CLEARANCES - UNVENTILATED COMPARTMENTS

CAUTION: CLEARANCES

- Top and bottom clearances must not be reduced below the values shown in table 16 as they are the minimum clearances required for servicing.

Unventilated Compartment Installation Clearances (millimetres)			
The suggested total unventilated compartment minimum clearances are:			
Side	Above	Below	Front (to removable door)
400	170 approx. (30 above the elbow)	200	100

Tab. 16 Minimum unventilated compartment clearances

If Side Clearances are Reduced (millimetres)			
If total side clearance is reduced to: (Combined left and right clearances excluding the appliance)	Increase height clearances to (approx): (Combined top and bottom clearances excluding the appliance)	OR	Front clearance (to removable door) must be increased to:
350	441		129
300	523		161
250	617		200
200	717		243
150	856		295
100	1012		358
50	1202		434

Tab. 17 Reduced side clearances

If Front Clearance is Reduced (millimetres)			
If front clearance (to removable door) is reduced to:	Increase overall height clearances to approx: (Combined top and bottom clearances excluding the appliance)	OR	Increase total side clearance to: (Combined left and right clearances excluding the appliance)
50	511		505
25	596		569

Tab. 18 Reduced front clearances

3.7 PLUMBING MANIFOLD

3.7.1 CONNECTIONS

WARNING: IF FITTING AN OPTIONAL INTERNAL DIVERTER VALVE

- ▸ Refer to the “Greenstar Optional Integral Diverter Valve” installation instructions.

Heating System	22mm compression fittings
Gas	22mm

Tab. 19

Use the fittings supplied in the Hardware literature pack.

- If the boiler pipes are to be run behind the appliance ensure that the pipes pass through the slot in the white cardboard guide. This is fitted to the frame.

Further guidance on pipe routing can be found printed on the boiler template (supplied with the boiler).

- For further ease of fitting, an optional Vertical Pre-piping Assembly kit is available, comprising five pre-formed copper pipes and an earth bonding strip. Part number: 7 716 192 570.
- To cover the pipe work under the boiler, down to the counter top, an optional “Below boiler pipe cover” can be used.
  Part number: 7 716 192 608

Fig. 20 Pipe dimensions

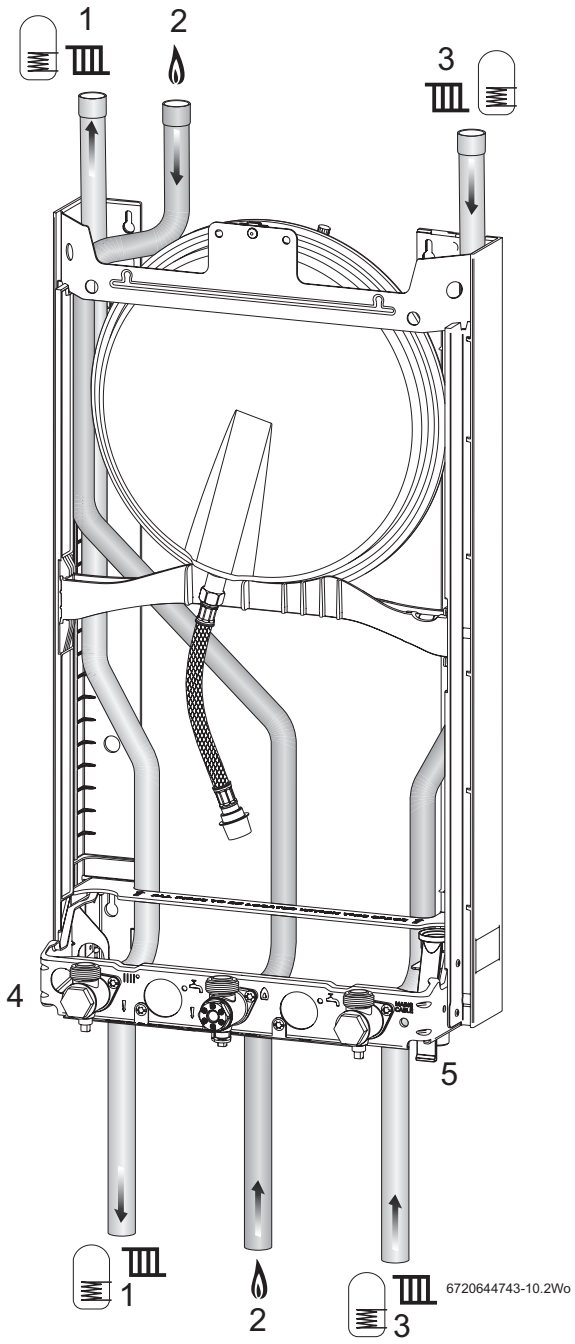


Fig. 21 Plumbing manifold

#	Function	From left case edge	Diameter of pipe
1	CH Flow	70 mm	22 mm
2	Gas	200 mm	22 mm
3	CH Return	330 mm	22 mm
4	Condensate	35 mm	22 mm
5	Pressure Relief Valve	367 mm	15 mm

Tab. 20 Key to figures 20 & 21

3.8 FLUE OPTIONS

CAUTION: Non accessible flue systems:
- Where a flue system is not going to be accessible, provision must be made for service and inspection.
- Voids containing concealed flues must have at least one inspection hatch no less than 300mm square.
- Flue joints within the void must not be more than 1.5 metres from the edge of the inspection hatch.
- Inspection hatches should be located at changes of direction.
- If this is not possible, bends should be viewable from both directions.

NOTICE: Effective flue lengths:
- each 90° bend used is equivalent to 2 metres of straight flue
- each 45° bend used is equivalent to 1 metre of straight flue

Plume management kits are available for the 60/100 horizontal flue system.
Refer to the manual supplied with the plume management kits for complete installation instructions

FLUE LENGTHS

The flue systems have different maximum flue lengths

The Greenstar series has the option of two horizontal 60/100 RSF (telescopic and longer telescopic) and one horizontal 80/125 RSF (telescopic) flue system and two vertical RSF (60/100 or 80/125) flue systems:

The next page shows various fluing options.

Refer to the Flue options in table 21 for the straight flue lengths required to achieve the maximum flue length.

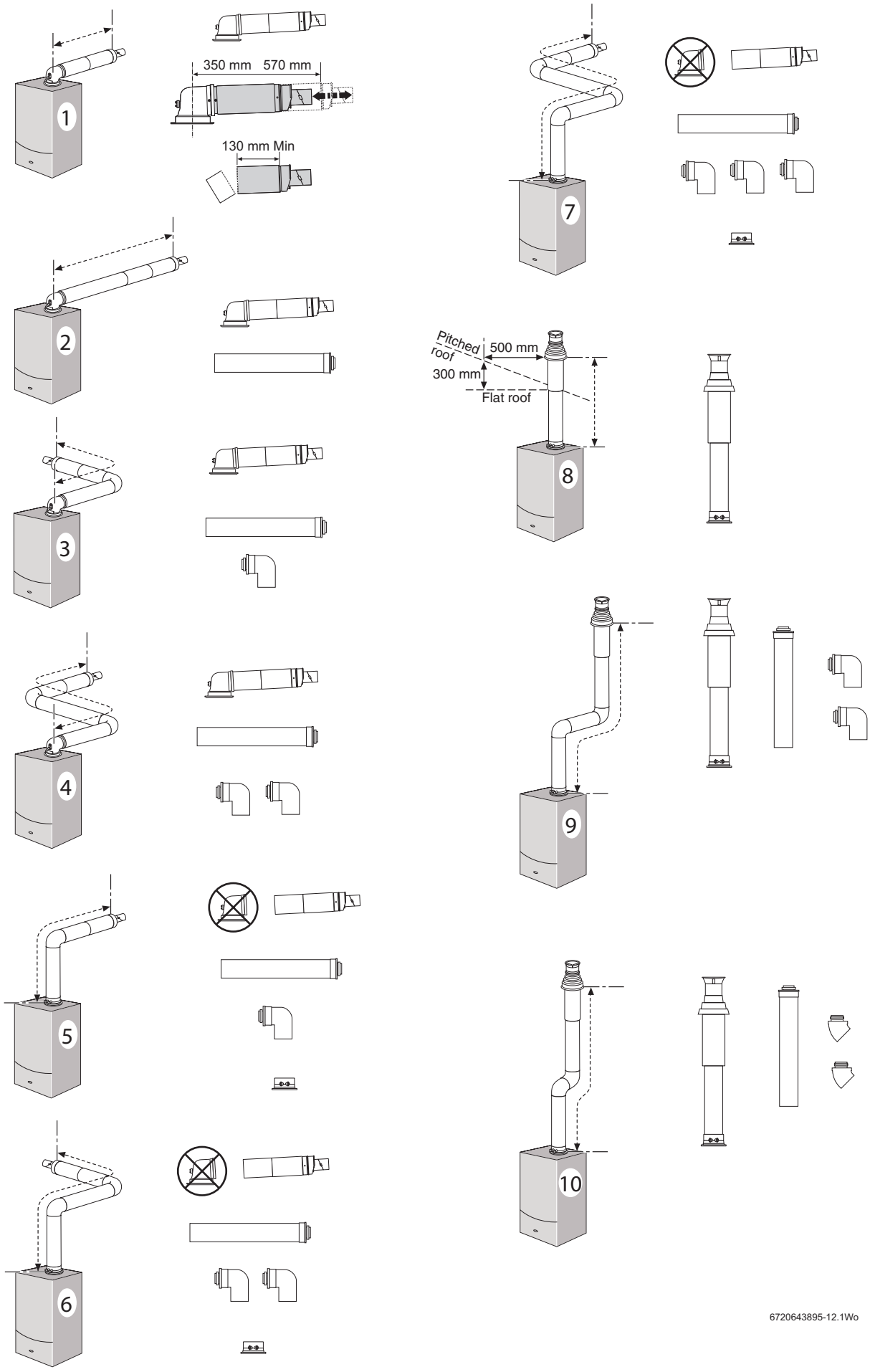
Condensfit II

	i System boilers	Maximum total flue length (mm)	
FLUE TYPE		60/100	80/125
1	Telescopic horizontal flue assembly	570	1,070
	Longer telescopic horizontal flue assembly	790	N/A
2	Horizontal flue extension	4,600	13,000
3	Horizontal flue with 1 x 90° bend	2,600	11,000
4	Horizontal flue with 2 x 90° bends	N/A	9,000
5	High level horizontal flue	4,600	13,000
6	High level horizontal flue with 2 x 90° bends	2,600	11,000
7	High level horizontal flue with 3 x 90° bends	N/A	9,000
8	Vertical balanced flue assembly	6,400	15,000
9	Vertical balanced flue with 2 x 90° bends	2,400	11,000
10	Vertical balanced flue with 2 x 45° bends	4,400	13,000

Tab. 21 Flue options

Part number	Flue	Description
7 716 191 082	60/100	Telescopic horizontal flue assembly
7 716 191 171	60/100	Longer telescopic horizontal flue assembly
7 719 003 702	80/125	Telescopic horizontal flue assembly
7 719 002 430	60/100	Vertical flue assembly
7 719 002 431	80/125	Vertical flue assembly

Tab. 22 Flue option part numbers


1
350 mm
570 mm
130 mm Min
2
3
4
5
6
7
Pitched roof
500 mm
300 mm
Flat roof
8
9
10
6720643895-12.1Wo

3.9 FLUE TERMINAL POSITIONS

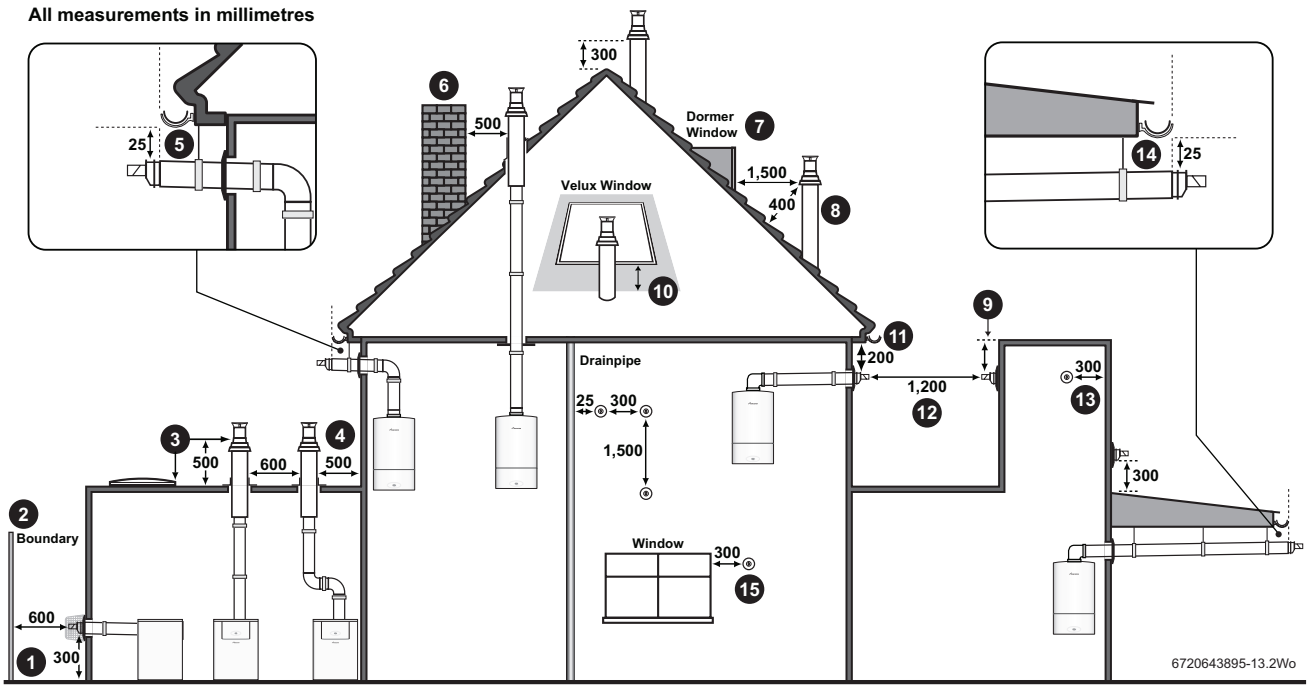


Fig. 22 Flue terminal positions

NOTICE:

- All measurements are the minimum clearances required.
- Terminals must be positioned so to avoid combustion products entering the building.
- Support the flue at approximately one metre intervals and at a change of direction, use suitable brackets and fittings (Flue brackets 100mm x 6 part number: 7 716 191 173, Flue bracket 125mm part number :7 716 191 174).

Key to illustration

1. Flue clearance must be at least 300mm from the ground. Terminal guards must be fitted if the flue is less than 2 metres from the ground or if a person could come into contact with the flue terminal.
2. 600mm distance to a boundary, unless it will cause a nuisance. BS 5440: Part 1 recommends that care is taken when siting terminals in relation to boundaries.
3. 600mm minimum clearance from a skylight to a vertical flue.
4. Vertical flue clearance, 500mm to non-combustible building material, and 1,500mm clearance to combustible building material.
5. The dimension below eaves, gutters, pipes and drains can be reduced to 25mm, as long as the flue terminal is extended to clear any overhang. Any external flue joints must be sealed with a suitable silicon sealant.
6. 500mm clearance to any vertical structure on a roof, 600mm to room sealed flue or 1,500mm to an open flue.
7. 1,500mm between a vertical flue terminal and a window or dormer window.
8. 400mm from a pitched roof or in regions with heavy snow fall 500mm.
9. The flue cannot be lower than 1,000mm from the top of a light well due to the build up of combustion products.
10. 2,000mm below a Velux window, 600mm above or to either side of the Velux window.
11. 200mm below eaves and 75 mm below gutters, pipes and drains.
12. 1,200mm between terminals facing each other.
13. 300mm to an internal or external corner.

Installations in car ports are not recommended.

14. The dimension below eaves, balconies and car ports can be reduced to 25 mm, as long as the flue terminal is extended to clear any overhang. Any external flue joints must be sealed with suitable silicon sealant.
15. 300mm above, below and either side of an opening door, air vent or opening window.

3.10 PLUME MANAGEMENT TERMINAL POSITIONS

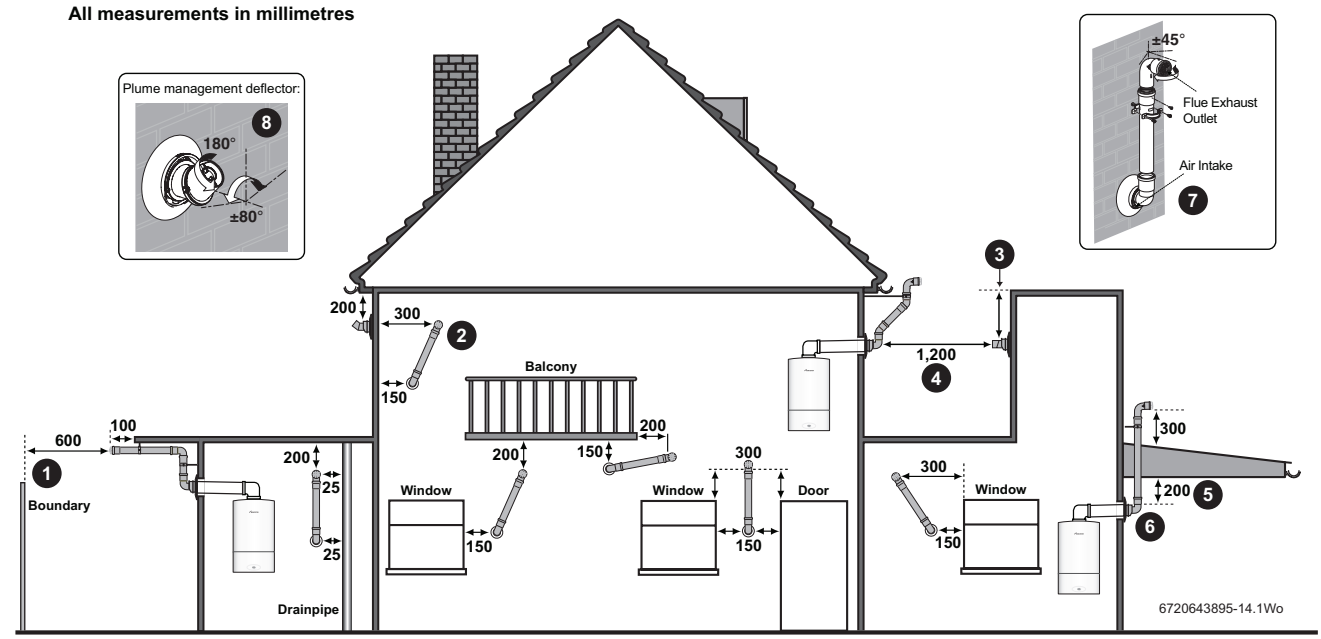


Fig. 23 Plume terminal positions

NOTICE:

- Maximum effective plume management length = 4,500mm.
- Additional 90° bends = 1,500mm of straight pipe and additional 45° bends = 750mm of straight pipe.
- Minimum plume management length = 500mm.
- All measurements are the minimum clearances required.
- Refer to figure 22 for all concentric flue terminal positions unless the flue position is specified on the figure above “Plume terminal positions”.
- Terminals must be positioned so to avoid combustion products entering the building.
- Support the flue at approximately one metre intervals and at a change of direction, use suitable brackets and fittings.

Key to illustration

1. 600 mm distance to a boundary or surface facing a boundary, unless it will cause a nuisance. BS 5440: Part 1 recommends that care is taken when siting terminals in relation to boundaries.
2. Internal/external corners. The air intake clearance can be reduced to 150 mm providing the flue exhaust outlet has a 300 mm clearance.
3. The flue cannot be lower than 1,000 mm from the top of the light well due to the build up of combustion products.
4. 1,200 mm between air intake and facing terminal.
5. Clearance no less than 200 mm from the lowest point of the balcony or overhang.

Installations in car ports are not recommended.

6. 1,200 mm from an opening in a car port on the same wall i.e. door or window leading into dwelling.
7. Using a Plume Management Kit the air intake measurement can be reduced to 150 mm providing the flue exhaust outlet has a 300 mm clearance. Plume kits running horizontally must have a 10° fall back to the boiler for proper disposal of condensate. For details on specific lengths see relevant boiler Technical & Specification information.
8. This feature allows some basic plume re-direction options on a standard telescopic horizontal flue terminal.
   300 mm minimum clearances to a opening e.g. window.
   However the minimum clearance to an opening in direction that the plume management is facing, must be increased to 1,500 mm.
   Where the flue is less than 150 mm to a drain pipe and plume re-direction is used the deflector should not be directed towards the drainpipe.

4 INSTALLATION

WARNING: All the previous “Pre-Installation” sections must be read and the requirements met before starting boiler or flue installation.

4.1 UNPACKING THE WALL FRAME AND ANCILLARY ITEMS

CAUTION: LIFTING AND CARRYING

- Only lift a manageable weight, or ask for help.
- Bend the knees and keep the back straight with feet apart, when lifting or putting down heavy objects.
- DO NOT lift and twist at the same time.
- Lift and carry object close to the body.

1. Wall mounting frame
2. Wall mounting template
3. Inner packaging
4. Installer pack
5. Bottom panel
6. Front fascia
7. Syphon assembly

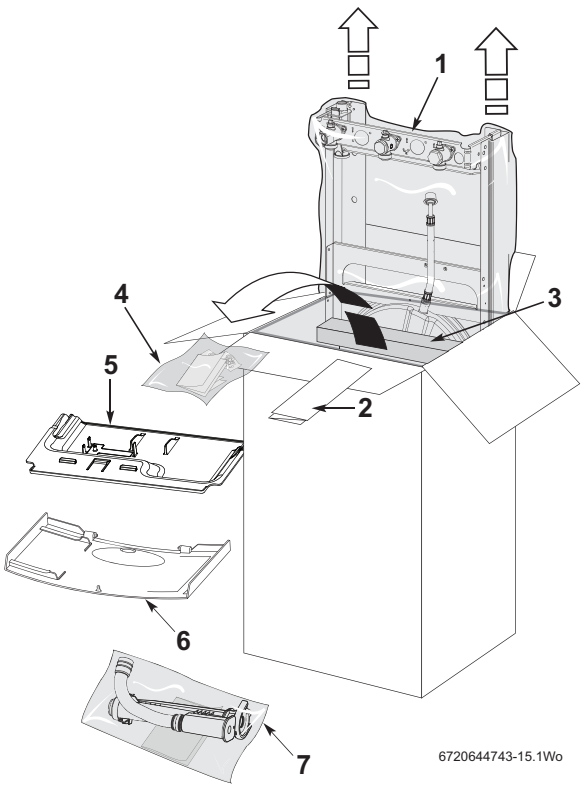


Fig. 24 Unpacking

IMPORTANT HANDLING INSTRUCTIONS:

- It is advised that two people are used to carry the carton from the van to the point of delivery.
- Once the carton has been delivered, the outer carton is removed first. Care should be taken when releasing the straps. If a sharp implement is used make sure the outer carton is not pierced and that the implement is used in such a way so that it may not cause personal injury.
- All sharp objects must be covered or the blade retracted after use and put away in a safe place. Care should be taken when lifting the boiler from the base and the proper technique for safe lifting of any heavy object should be strictly observed.

Additional requirements for roof space installation:

- The boiler should be first unpacked before ascending ladder to loft space.
- Two sets of steps should be used.
- Two people should share the lifting of the boiler up to the loft hatch, where the boiler is entered into the loft space tilted and slid on its back into the loft.
- Once the appliance is removed from its packaging check the contents against the packing list.

NOTICE:

- **Before installing the appliance, ensure that the system has been cleaned as explained on page 11**.

1. Remove straps and open the top of the boiler packaging.
2. Remove the wall mounting frame (1) and wall mounting template (2) and from the packaging.
3. Remove the boiler bottom panel (5), front fascia (6), hardware literature pack (4) and syphon assembly (7) from the carton.

4.2 WALL MOUNTING TEMPLATE & FLUE OPENING

WARNING: BEFORE DRILLING: ENSURE THAT THERE ARE NO PIPES, ELECTRICAL CABLES, DAMP PROOF COURSES OR OTHER HAZARDS .

SAFETY:

All relevant safety precautions must be undertaken. Protective clothing, footwear, gloves and safety goggles must be worn as appropriate.

FIXING THE WALL MOUNTING FRAME:

- The boiler template shows the relative positions of the flue and the top and bottom fixing of the mounting frame.

1. Fix the template to the wall in the desired position.
2. Drill 4 holes for the wall mounting frame through the template.

The wall mounting template has been sized to allow for minimum clearances of 5mm sides, 200mm base and 30mm above a 100mm diameter flue elbow.

REAR FLUE OUTLET

- The drawing opposite shows the boiler template with the flue centre lines of both the 100 mm and 125 mm flue systems.

3. Mark centre line of flue to be used (3); the external diameter of the hole can also be marked if required.

- If a 100 mm diameter flue is to be used, a 125 mm diameter hole is required. However, if using the weather sealing collar by pushing it through from inside the property, then a 150 mm diameter hole is required to accommodate this.
- The flue turret of the 100 mm flue has an in-built 3° angle.
- If extensions are to be added then the complete flue must rise at an angle of 3°.
- The 125 mm diameter flue system will require the flue to rise at an angle of 3°.
- Drill hole using a core drill or similar.

SIDE OUTLET:

4. Mark from the centre line of the wall template to the wall which the flue will pass through (4).

- Allow for a rise of 52mm per metre length of flue, to give a 3° angle.
- Clear any debris from the site.

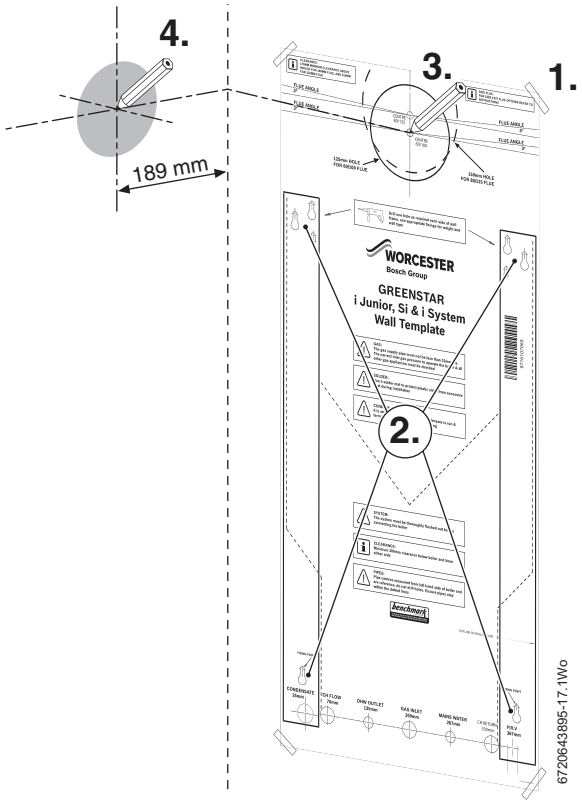


Fig. 25 Marking the flue position

4.3 UNPACKING THE APPLIANCE

1. Outer carton
2. Inner sleeve (unwrap from front)
3. Packing base
4. Protective wrapping
5. Appliance outer case

- ▸ Remove outer carton (1) and place safely away from the working area.
- ▸ With the outer packaging removed and the inner sleeve (2) still in place gently lay the boiler on its back.
- ▸ The boiler will lie at an angle to the floor to allow the boiler outer casing (5) to be removed.
- ▸ The inner sleeve (2) opens as shown in figure 28.
- ▸ Remove the protective wrapping (4).

1. Undo but do not remove the two screws at the bottom of the boiler
2. Undo the two screws at the top (see fig. 29).
3. Remove the outer case (5).

- ▸ Remove any packaging within the boiler and the packaging base (3).

CAUTION: Hanging the boiler

- ▸ Remove the plastic strip fitted to pipes before hanging the boiler.

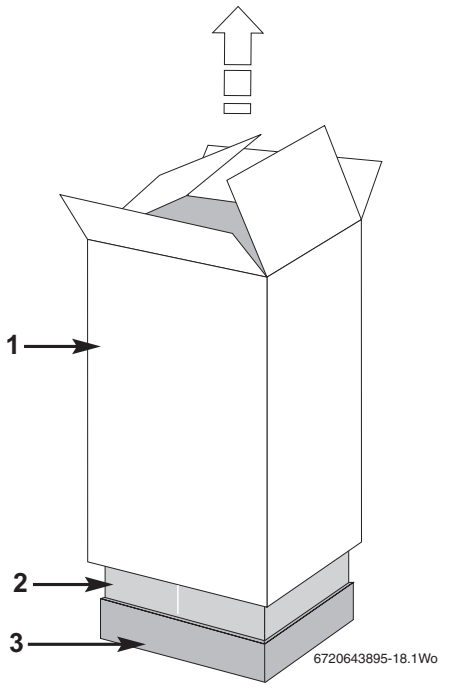


Fig. 26 Remove outer carton

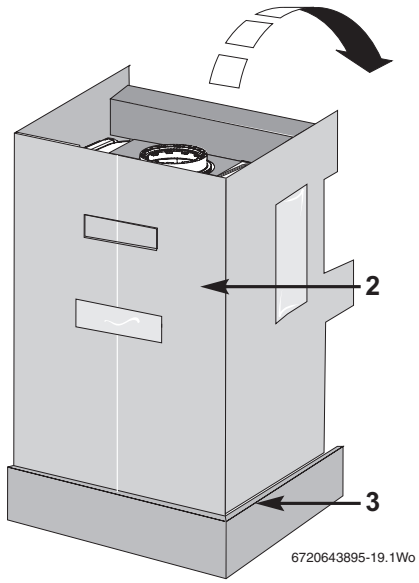


Fig. 27 Lay boiler down

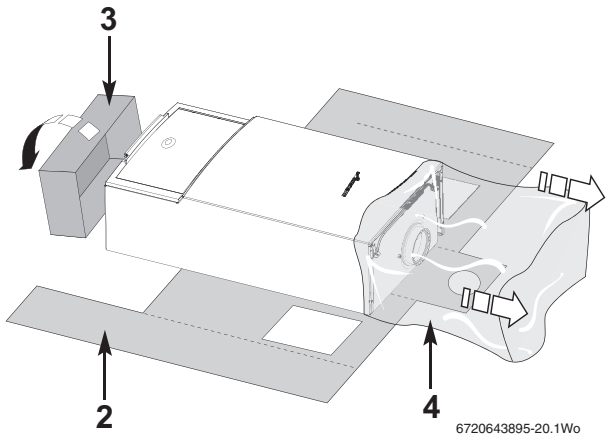


Fig. 28 Remove packaging

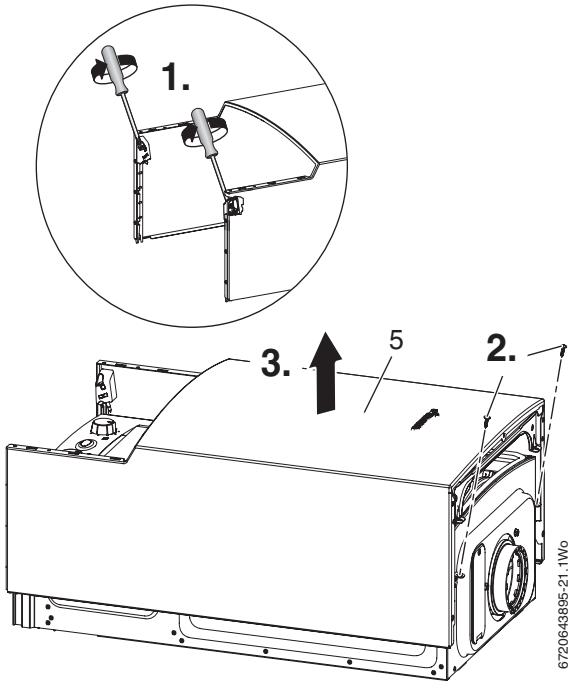


Fig. 29 Outer case screw removal

4.4 BOILER CONNECTIONS

CAUTION: ISOLATE THE MAINS GAS SUPPLY BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

NOTICE: DIVERTER VALVE

- If the optional integral diverter valve kit is required, fit the kit now before hanging the boiler on the wall frame.

GAS AND WATER CONNECTIONS

- Remove wall mounting template and secure the wall mounting frame to the wall with the appropriate fittings for the boiler weight and wall type.
- System pipes may be run vertically upwards behind the boiler or below it. See Plumbing Manifold Section on page 20.

1. CH flow (22mm),
2. Gas inlet (22mm),
3. CH return (22mm),

The bonded washer supplied is for the Gas connection only.

FITTING THE CONDENSATE PIPE WORK

Pre-fit the plastic condensate drain pipe through the wall frame as shown in the example below.

1. Secure the pipe to the wall at the last joint.
2. Ensure the pipe protrudes through the wall frame by 25mm.

- If exiting through the wall, to run externally, the pipe must have a 3° fall and be increased to a 32mm insulated pipe.

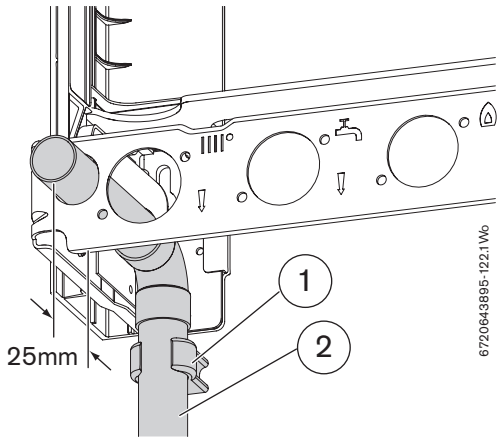


Fig. 30 Condensate drain pipe work detail

PREPARING THE WALL FRAME

- Fit sealing washers to service valves before hanging boiler.

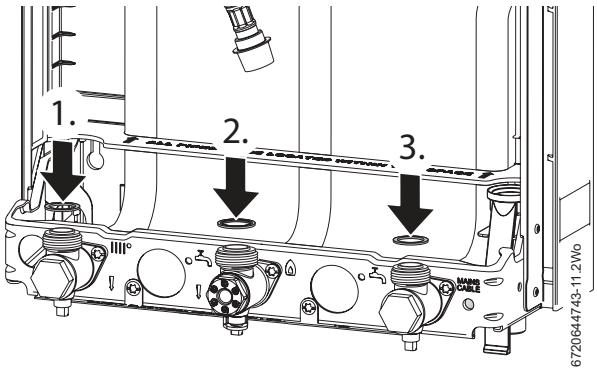


Fig. 31 Sealing washers

NOTICE: Before hanging the boiler onto the wall mounting frame ensure that the pressure relief valve connection is in the DOWN position.
This is located on the right hand side of the wall frame at the rear.
Apply a smear of silicone lubricant to the seal to ease connection later.

1. Pull the extended tab/lever forward and down until there is no further travel.

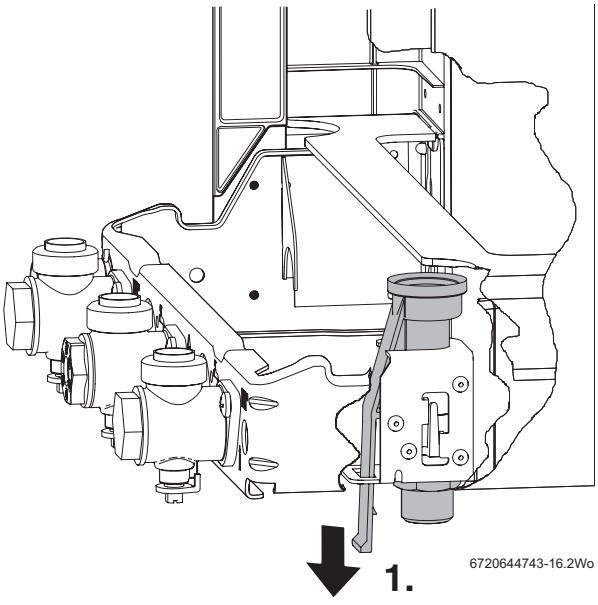


Fig. 32 PRV connection in the down position

CAUTION: Caps or plastic strip fitted to pipes must be removed before hanging the boiler.

HANGING THE BOILER

- Hang the boiler on to the wall mounting frame by the two brackets positioned left and right at the top rear of the appliance.
  Do not lift the appliance by the air gas manifold. There are two handling holes incorporated into the inner casing left and right in the lower section of the appliance.

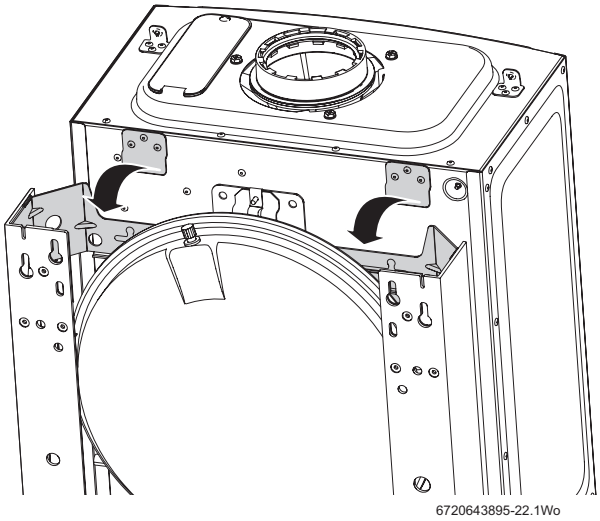


Fig. 33 Hanging the boiler

PRESSURE RELIEF CONNECTIONS

NOTICE: The pressure relief connector must be repositioned after the boiler has been correctly mounted to the wall mounting frame.

To ease assembly of components, apply silicone lubricant to sealing surfaces.

1. Push the lever on the pressure relief connector UP until the stop on the inside of the handle is over the shoulder of the metal bracket to secure in place.

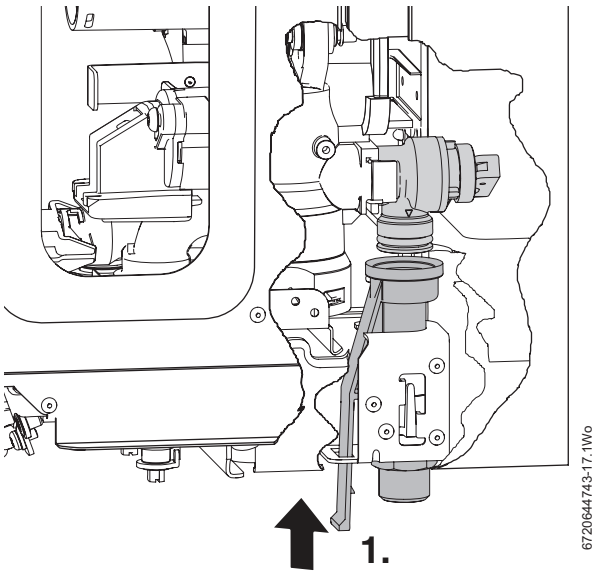


Fig. 34 PRV in the up position

- Remove the screw from the control panel retaining bracket and lower the control panel into the service position.
- Make connections to the heating system.
  Connect the gas supply to the boiler gas cock 22mm compression.

EXPANSION VESSEL CONNECTION

To connect the expansion vessel flexible pipe to the hydraulic manifold situated to the left of the pump:

- Remove and discard the plastic cap from the expansion vessel flexible pipe.

1. Refer to figure 35, release the retaining clip.
2. Remove and discard the orange plastic blanking plug from the pressure vessel connection at the hydraulic manifold.

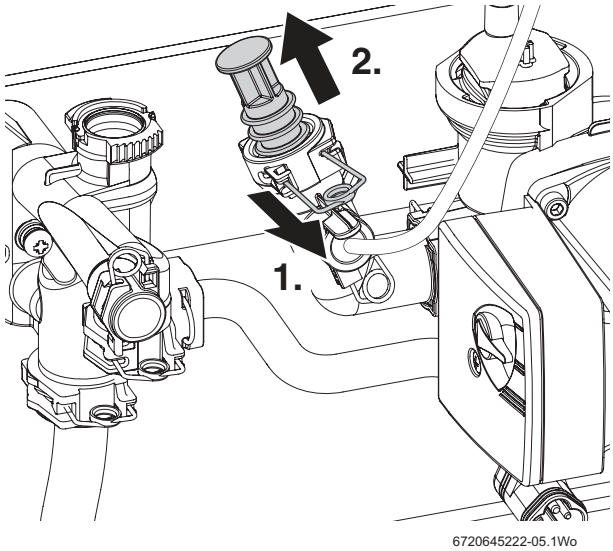


Fig. 35 Blanking plug

1. Refer to figure 36 and insert the expansion vessel flexible pipe it to the fitting on the pump.
2. Secure in place with the wire retaining clip.

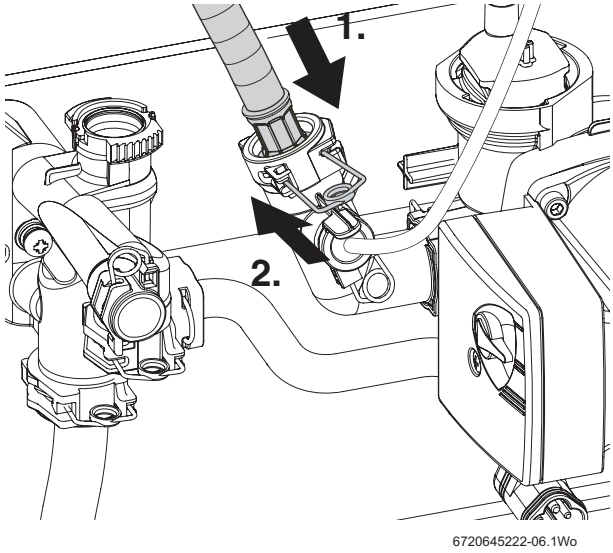


Fig. 36 Expansion vessel hose connection

- Connect the pressure relief drain pipe to 15mm compression joint using the compression nut and olive supplied in the literature/hardware pack.

4.5 FLUE INSTALLATION

HORIZONTAL FLUE (60/100mm diameter)

For vertical flues and 80/125mm horizontal flues, please refer to separate instructions supplied with the flue kit.

To ease assembly of flue components, apply silicone lubricant to sealing surfaces.

Basic instructions for the 60/100mm diameter flue are shown below.

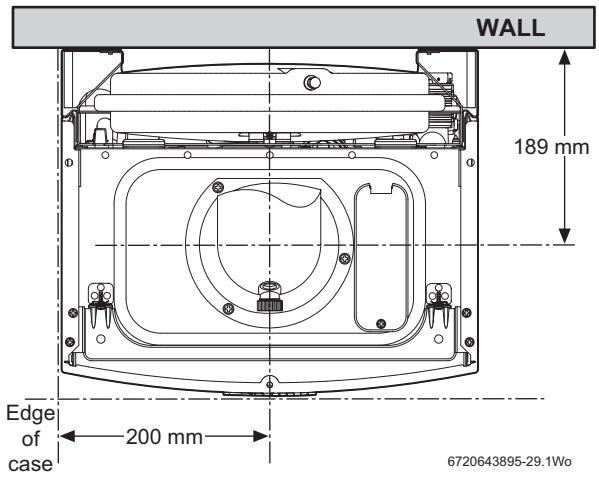


Fig. 37 Flue turret centre

4.5.1 MEASURING THE FLUE (STANDARD FLUE):

- Measure from the outside of the wall to the centre line of the flue turret to determine length L.
- Subtract 50mm from the length L to give the correct dimension to the flue elbow connection.
- If the length L falls within the telescopic range of 350 to 570mm or 570 to 790mm using the longer telescopic flue, then no cutting will be required.
- If the required length is less than 350mm the standard telescopic flue can be modified, refer to fig. 39.
- If the required length is greater than 570mm, then the longer telescopic flue, giving a range of 570 - 790mm, can be used
- If the required length is greater than 790mm, then flue extensions will have to be used. Refer to the 60/100 Horizontal Flue Instruction manual provided in the telescopic flue kit.
- Refer to section 3.8 for flue options.

Adjusting the telescopic flue length:

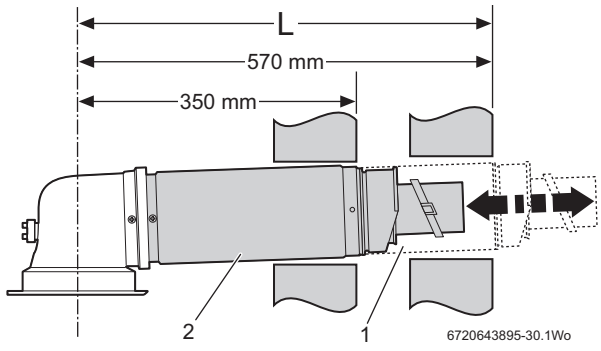


Fig. 38 Standard telescopic flue

Extend tube (1) by withdrawing from tube (2) to achieve the flue length required, between 350 - 570mm.

Secure with screw provided and seal joint with the aluminium tape supplied.

4.5.2 REDUCING THE TELESCOPIC FLUE LENGTH:

Ensure that the “TOP” label is facing up before securing the flue section to the turret.

The flue terminal MUST be fitted with the 'TOP' label uppermost to allow the correct fit and use of the plume management system.

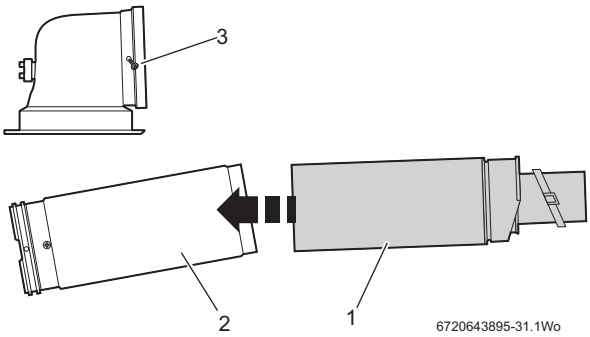


Fig. 39 Reducing the standard terminal

- Remove securing screws (3) to detach the terminal assembly from the turret.
- Slide terminal section (2) from the terminal assembly and discard.
- To use terminal (1) without cutting remove the location lug (4) on the inner flue tube (5) and remove any burrs.

To reduce the flue length further:

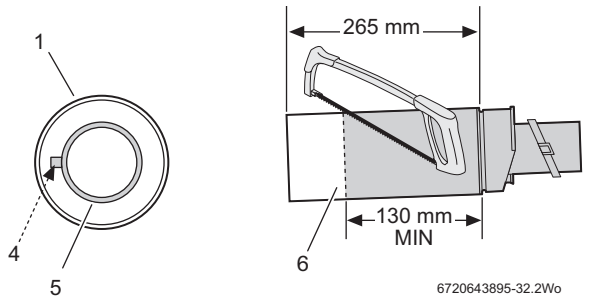


Fig. 40 Further reduction

- Mark the length required for the terminal as shown (min. 130mm) and cut square, taking care not to damage the tubes.
- Remove any burrs and chamfer the outer edge of the tubes to assist ease of connection and prevent seal damage.

The aluminium tape is not required when reducing the terminal.

4.5.3 INSTALLING THE TELESCOPIC FLUE:

Refer to figure 41.

1. Set the flue length to the distance required, secure with screws provided.
2. Seal the joint with the aluminium tape provided.
3. Slide the inner wall seal onto the terminal.
4. If fitting from inside the building; slide the outer wall seal onto the terminal.

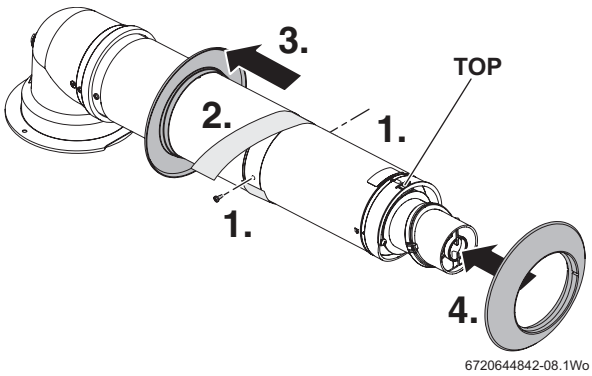


Fig. 41 Telescopic flue

The turret securing screws are from the boiler and are not in flue kit.

Refer to figures 42 & 43.

1. Remove the three inner flue tube retaining screws (2). The inner tube will be held in place in the appliance.
2. Check the boiler flue seal is correctly seated and apply silicone grease.
3. Position terminal through the flue opening in the wall to the outside of the building by the distance shown.
4. Align the flue turret to the boiler flue outlet with flat facing (1) to the rear of the boiler.
   The flue turret should be pushed straight down, on to the boiler.

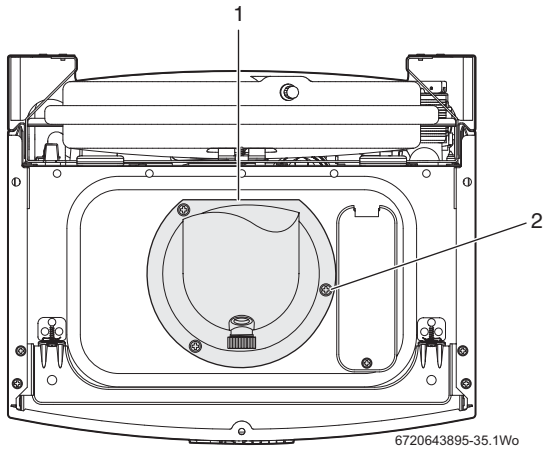


Fig. 42 Aligning the turret

▸ Fit the screws removed in step 1 to secure flue turret.

▸ If fitting the outer seal from outside the building, slide the outer wall seal onto the terminal as shown.

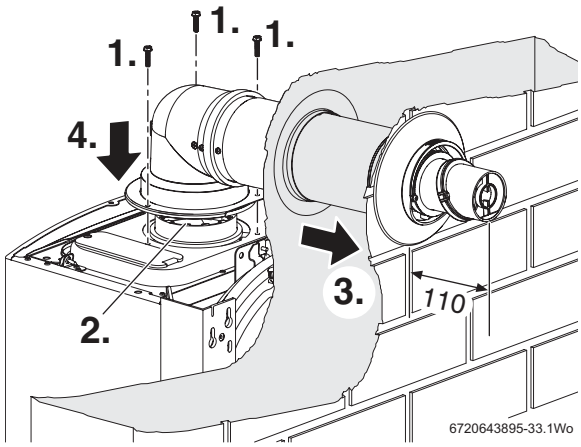


Fig. 43 Telescopic flue installation

For more information refer to the 60/100 Horizontal Flue kit Instruction Manual

ADDITIONAL NOTES AND REMINDERS:

- Ensure that all cut lengths are square and free from burrs.
- The flue is sealed when assembled correctly and the components are pushed fully home.
- The flue is set at an angle of 3° or 52mm per metre length.
- Support the flue at approximately one metre intervals and at a change of direction, use suitable brackets and fittings
  (Flue brackets 100mm x 6 part number: 7 716 191 173, Flue bracket 125mm part number :7 716 191 174)

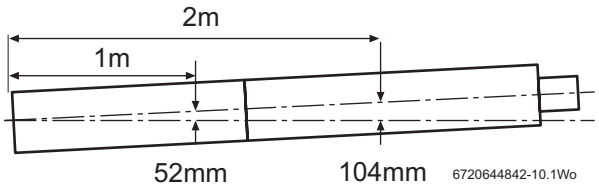


Fig. 44 Slope for condensate disposal

4.5.4 FLUE TERMINAL PLUME RE-DIRECTION

The flue discharge can be re-directed allowing some plume redirection control, alternatively, a complete plume management system can be fitted to the flue terminal.

RE-DIRECTING THE FLUE DISCHARGE

1. Using a suitable tool, unclip (1 & 2) the terminal end and rotate through 180°.

NOTICE: DO NOT rotate the complete terminal assembly.

1. Refit to the terminal, ensuring that the clips (1 & 2) are engaged and secure.
2. Loosen screws (3) and rotate the entire outlet assembly to redirect the plume. Tighten screws (3) to secure in the required position.

The flue terminal outlet has built-in stops to limit rotation for horizontal flue to allow condensate to run back into the boiler for safe disposal. Do not attempt to force beyond the limit stops.

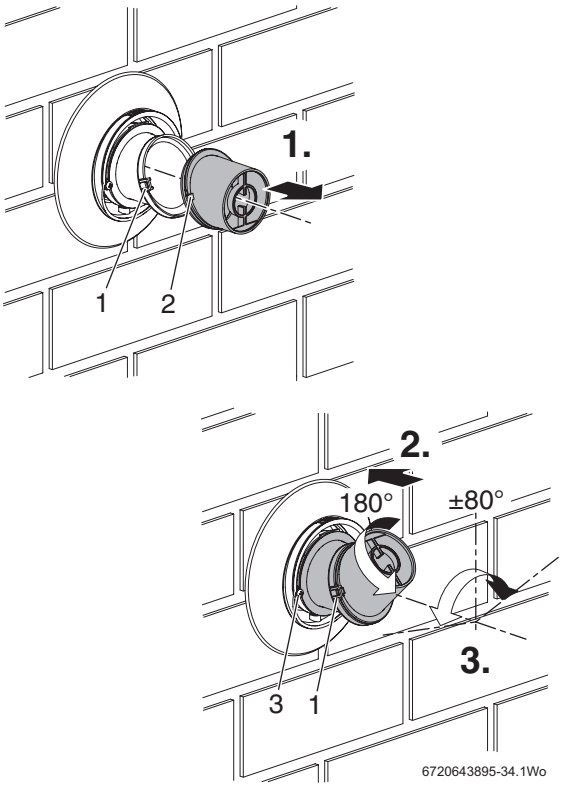


Fig. 45 Plume redirection

NOTICE: Outlet position

- The flue terminal outlet position must follow those stated in the relevant appliance instruction manual.
  When redirecting the flue discharge the outlet terminal must be at least 1500mm from any opening in the direction of the discharge to prevent combustion products from entering the building.

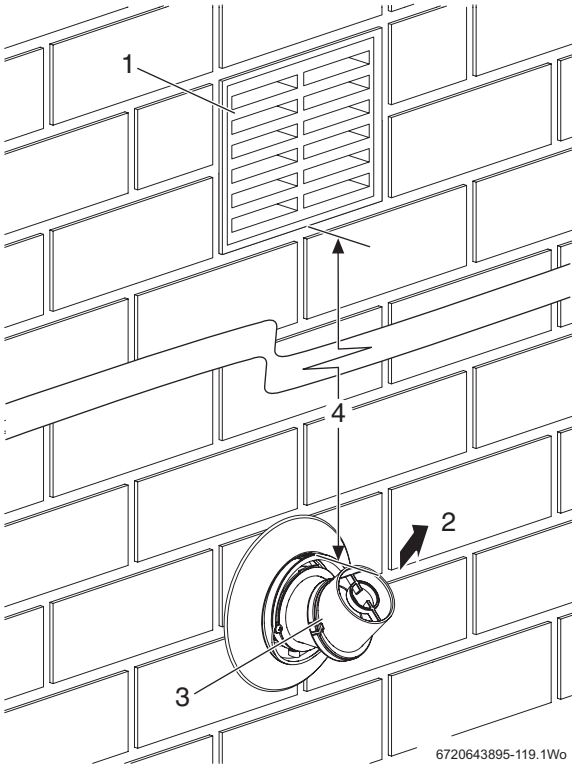


Fig. 46 Plume distance to opening

1	Opening in building
2	Flue discharge
3	Plume deflector
4	Minimum 1500mm from an opening in the building

Tab. 23 Key to figure 46

4.6 CONDENSATE CONNECTION

Never terminate or discharge into any open source, including; sink, bath, shower, bidet, toilet etc.

NOTICE: Any external condensate pipe work must be protected with weather resistant insulation to help prevent freezing.

• Ensure that the condensate drain is a 22mm diameter plastic pipe. The pipe must fall at least 50mm per metre towards the outlet.

Do not use lubricants or sealing compounds.

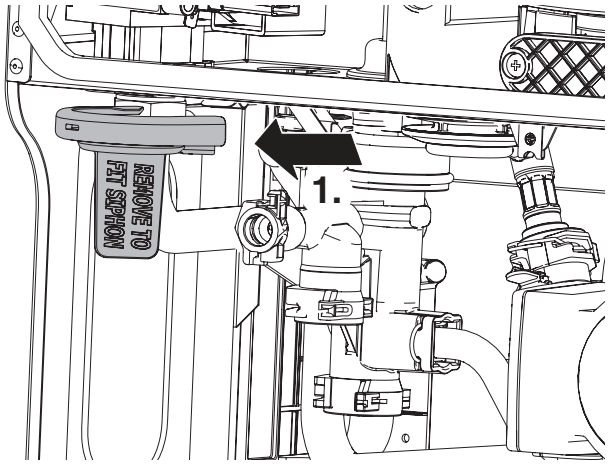


Fig. 47 Remove blanking cap

1. Remove the sump blanking cap from the sump.

▸ Fill syphon with 200 to 250 millilitres of water.

NOTICE: Pull the fan lead, DHW NTC sensor lead and ignition cable out of the way when fitting the syphon to ensure that they are not trapped by the syphon assembly or discharge hose.

2. To fit the syphon assembly:

▸ Remove orange seal retainer and discard.

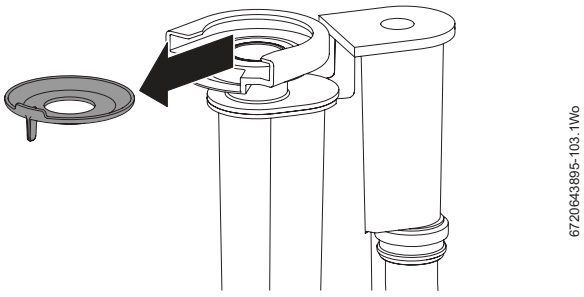


Fig. 48

▸ Push the syphon onto the sump assembly, until the lug on the sump is fully engaged with the slot on the back of the syphon assembly and the clip is engaged in the top of the syphon.

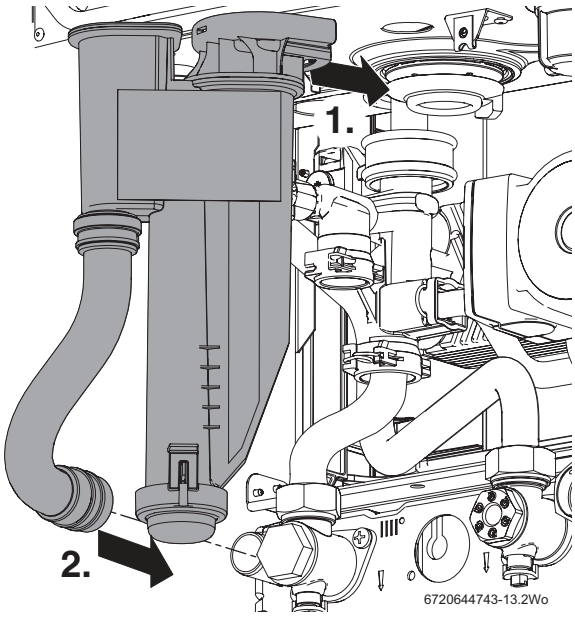


Fig. 49 Fitting syphon

NOTICE: Do not use solvents, adhesive or lubricant when pushing the pipe onto the rubber connector.

3. Push the discharge hose, onto the condensate outlet pipe.

Maintenance

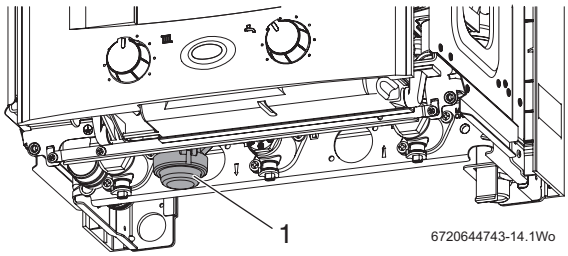


Fig. 50

There is no need to remove the Syphon Assembly for cleaning.

To drain debris from the syphon, during the annual service:

▸ Release the clips and remove the drainage cap from the bottom of the syphon.

▸ Empty the debris and condensate from the syphon into a suitable container.

▸ Re-fit the drainage cap to bottom of the syphon.

4.7 ELECTRICAL

CAUTION: ISOLATE THE MAINS ELECTRICITY SUPPLY BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

The boiler is pre-wired with a two metre mains supply cable.
A spare strain relief block is supplied in case the pre-wired cable is not used.

- The mains electrical supply to the boiler must be through either a fused double pole isolator or a fused three pin plug and unswitched socket.
- The isolator shall be situated next to the boiler for new systems and, where practicable, replacement boilers.
- The isolator must have a contact separation of 3mm minimum in both poles. Any system connected to the boiler must not have a separate electrical supply.
- External fuse rating 3A.

ACCESS TO ELECTRICAL CONNECTIONS:

▸ Remove boiler casing to access control panel.

Refer to figure 51.

1. Remove the screw securing the control panel.
2. Lower the control panel into the horizontal service position.

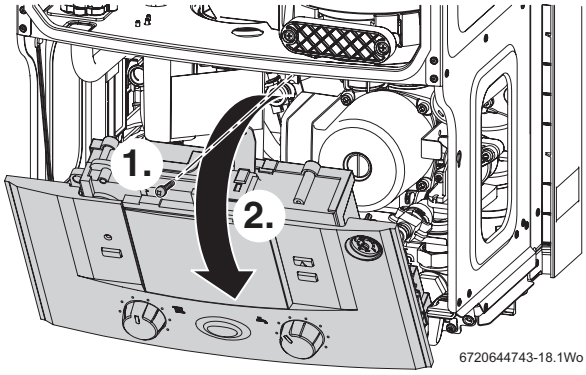


Fig. 51 Moving control panel into the service position

When stripping wires always ensure copper strands do not fall into the control box.

Refer to figure 52.

1. Unscrew the three screws in the control panel.
2. Pull off the connections cover.

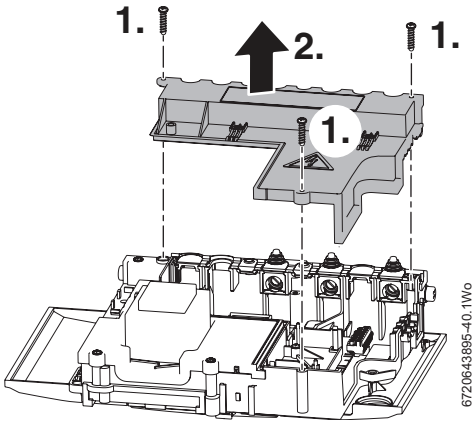


Fig. 52 Removing the connection cover

▸ Pass the 230 V mains power cable, from the control box, through the grommet at the right hand side of the pre-plumbing manifold and route to the mains isolator next to the boiler.

SI1	Fuse F1 2.5A
SI2	Fuse F2 0.5A
SI3	Fuse F3 1.5A
ST6	Frost thermostat connection
ST10	Mains in & external controls connections
ST19	EMS bus connection

Tab. 24

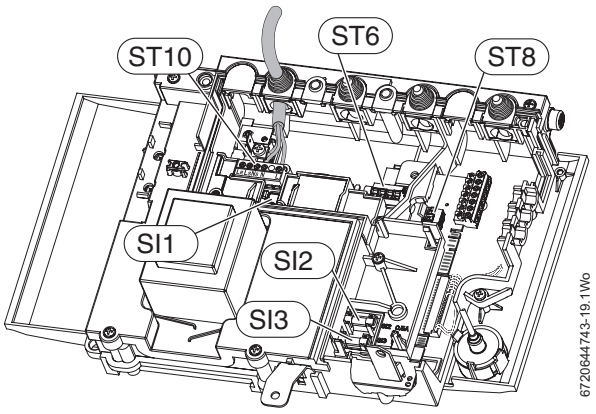


Fig. 53 Electrical connector information

NEW COMPLETE SYSTEM INSTALLATIONS

If a new complete heating system is installed in a new build property or it is a first time installation in an existing property, heating systems must conform to current building regulations Part L1a.

All new heating systems in dwellings must have at least two heating zones. Each of these zones will be controlled by a thermostat and zone valve.

The exception to this are single storey, open plan dwellings where the living area is more than 70% of the total useable floor area. Then this type of dwelling can be controlled as one zone.

An alternative would be individual electronically controlled TRVs. Hot water supplied would require separate time and temperature control.

For dwellings with a floor area over 150m^2, separate time and temperature control for each zone is required. All radiators must have TRVs fitted in all rooms except bathrooms and rooms with thermostats.

EXISTING INSTALLATIONS

For boiler replacements on an existing system, it is not necessary to zone the upstairs and downstairs differently, compliance with the zone requirements can be achieved by a single room thermostat or programmable room thermostat.

While the system is drained down, TRVs must be fitted to all rooms except the bathrooms and the room with the thermostat.

SYSTEM WIRING CENTRE CONNECTION (ST10)

Remove the link between L_R and L_S from ST10.

- Connect the LIVE feed wire from terminal (LS) to the LIVE on the system wiring centre.
- Connect NEUTRAL wire from terminal (NS) to the neutral on the system wiring centre.
- Connect SWITCHED LIVE wire from terminal (LR) to the boiler demand on the system wiring centre.

A pump is already fitted to the boiler!
No other pump should be fitted.

- Refit the control panels removed earlier.

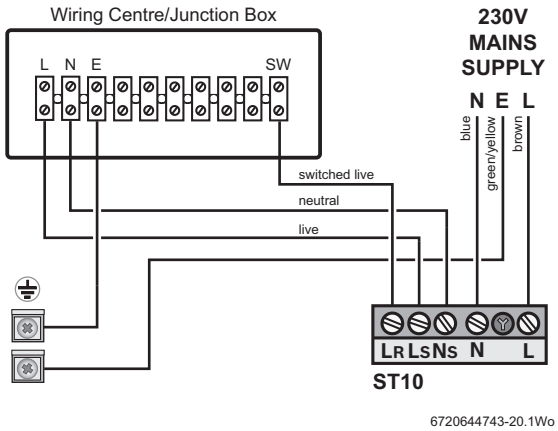


Fig. 54 Wiring centre

NOTICE:

- External diverter valve(s) and all other 230V parts are not supplied with the boiler.
- A fascia mounted programmer/timer cannot be fitted unless optional integral diverter valve is used.
- Refer to manufacturers' instructions when connecting external parts to the wiring centre.
- Worcester, Bosch Group cannot be held responsible for wiring errors.
- There is an option to fit an internal diverter valve. This also requires fitting an extra harness and a code plug change. See "Optional Diverter Valve" instructions supplied with the integral diverter valve kit.
- Option Integral Diverter Valve kits:
  12kW - 7 716 192 566
  15kW - 7 716 192 567
  18kW - 7 716 192 568
  24kW - 7 716 192 409

OPTIONAL EXTERNAL FROST STAT CONNECTION ST6:

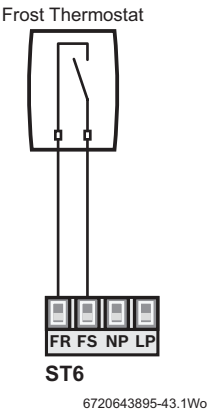


Fig. 55 Frost Thermostat

- Connect frost thermostat cables to terminals F_S & F_R.
- These are not polarity sensitive.
- The external frost thermostat only operates the pump (see page 68 for internal frost protection).

5 COMMISSIONING

5.1 PRE-COMMISSIONING CHECKS

CAUTION: ISOLATE THE MAINS ELECTRICITY SUPPLY BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

Check that the service and water pipes are connected to the correct position on the manifold.

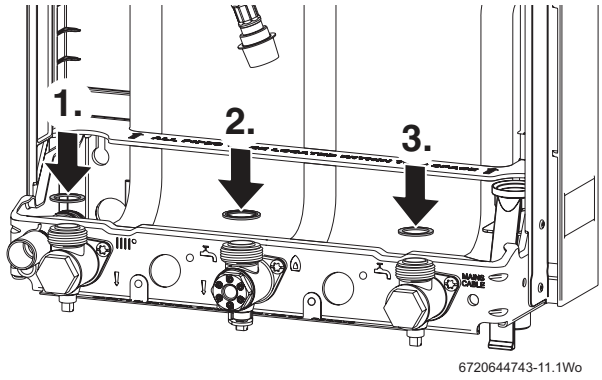


Fig. 56 Pipe fittings

Ensure that the washers have been fitted to the water connections and the bonded washer to the gas connection on the manifold.

1. - CH Flow (22mm)
2. - Gas inlet (22mm)
3. - CH Return (22mm)

- Check the gas type specified on the identification plate (1), on the inside of the flap, matches that of the gas supply.

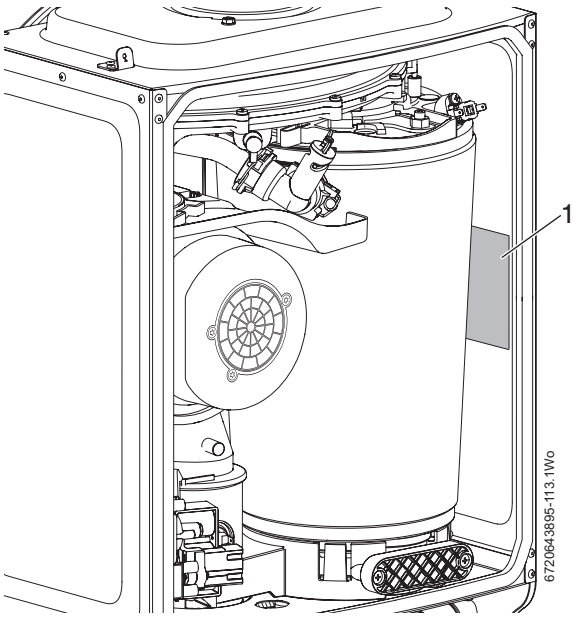


Fig. 57 Identification plate

- Turn on the main gas supply, check the gas pipe work, connections and rectify any leaks.
- Check that the discharge pipe (1) has been connected to the syphon and condensate outlet pipe.

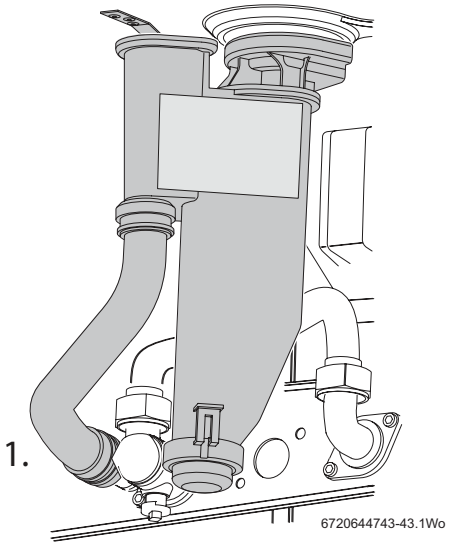


Fig. 58 Syphon connection

- Referring to figure 59, check pressure relief drain pipe (1) is correctly fitted and securely tightened.

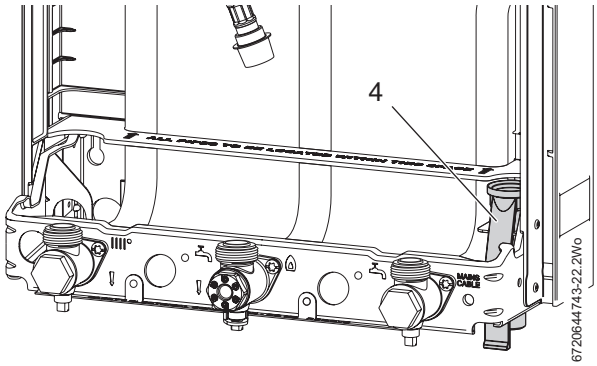


Fig. 59 Pressure relief drain pipe

NOTICE: If the boiler is not to be commissioned immediately then, after successfully completing all of the checks and any rectification work:

- Close the gas valve
- Close the water shut off valve
- Isolate the gas supply
- Isolate the electricity supply
- Label appropriately

5.2 FILLING THE SYSTEM

1. Turn on the water main and open the system valves.
2. Open all radiator valves.
3. Fill the system via a WRAS approved filling loop to 1 bar then turn the valve anti-clockwise to close.
4. Vent (1) any air from the boiler heat exchanger using a suitable container to collect any water. Ensure tube outlet (2) is directed away from the fan or any other electrical component to prevent any water damage. Also place a suitable cover over the fan to prevent any spillage of water on to electrical connections. Ensure the cover is removed after venting.

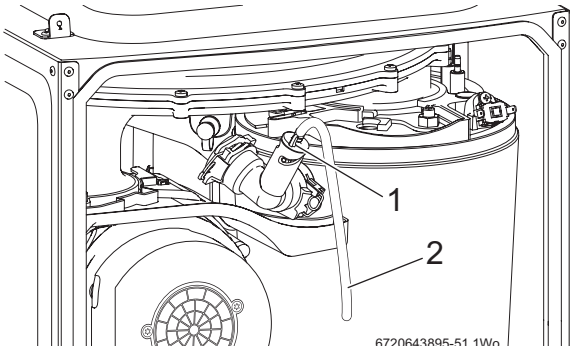


Fig. 60 Venting

5. Vent all radiators, tighten when completed and check the system and correct any leaks.

- The boiler integral expansion vessel is pre-charged to 0.75 bar (equal to a static head of 7.5m (22ft). A Schraeder type valve is fitted to the expansion vessel to allow for pressure adjustment if required.
- If an extra expansion vessel is fitted to the central heating return, adjust this to the same pressure as the appliance internal expansion vessel, refer to separate instructions with the extra expansion vessel.

6. Briefly open the pressure relief valve to test its operation.
7. If required increase system pressure back to 1 bar.
8. Isolate and remove filling loop connection to system or if using the optional integral filling connection (not supplied with the boiler) remove the key and place in its storage position on the bottom cover of the boiler.

5.3 WATER TREATMENT

NOTICE:
- ARTIFICIALLY SOFTENED WATER MUST NOT BE USED TO FILL THE CENTRAL HEATING SYSTEM.

ENSURE THAT THE SYSTEM HAS BEEN CLEANED AS ON PAGE 11 OF THESE INSTRUCTIONS.

FLUSHING (Central Heating):

- Switch off the boiler.
- Open all drain cocks and drain the system while the appliance is hot.
- Close drain cocks and add a suitable flushing agent at the correct strength for the system condition in accordance with the manufacturer's instructions.
- Run the boiler/system at normal operating temperature for the time stated by the manufacturer of the flushing agent.
- Drain and thoroughly flush the system to remove the flushing agent and debris.

INHIBITOR (Central Heating):

- Check drain cocks are closed and all radiator valves are open before adding a suitable inhibitor compatible with aluminium (or combined inhibitor/ anti-freeze if the system is exposed to freezing conditions) to the heating system water in accordance with the manufacturers instructions.

The pH value of the system water must be less than 8 or the appliance warrantee will be invalidated.

- Fill system via a WRAS approved filling loop to between 1 and 2 bar.
- Vent all radiators; tighten vents when complete.
- Vent any air from the boiler heat exchanger using a suitable container to collect any water.
- Ensure tube outlet is directed away from the fan or any other electrical component to prevent damage. Also place a suitable cover over the fan to prevent any spillage of water onto electrical connections. Ensure the cover is removed after venting.
- Vent all radiators.
- Re-pressurise if necessary to 1bar.
- Set all controls to maximum.
- Record the date when the inhibitor was added to the system on the warrantee card.

NOTICE:
- The concentration of inhibitor in the system should be checked every 12 months or sooner if content is lost.
- The addition of sealing agents to the system water is not recommended as this can cause problems with deposits left in the heat exchanger.

5.4 STARTING THE APPLIANCE

CAUTION: RUNNING THE APPLIANCE

- Never run the appliance when the appliance/system is empty or partially filled.

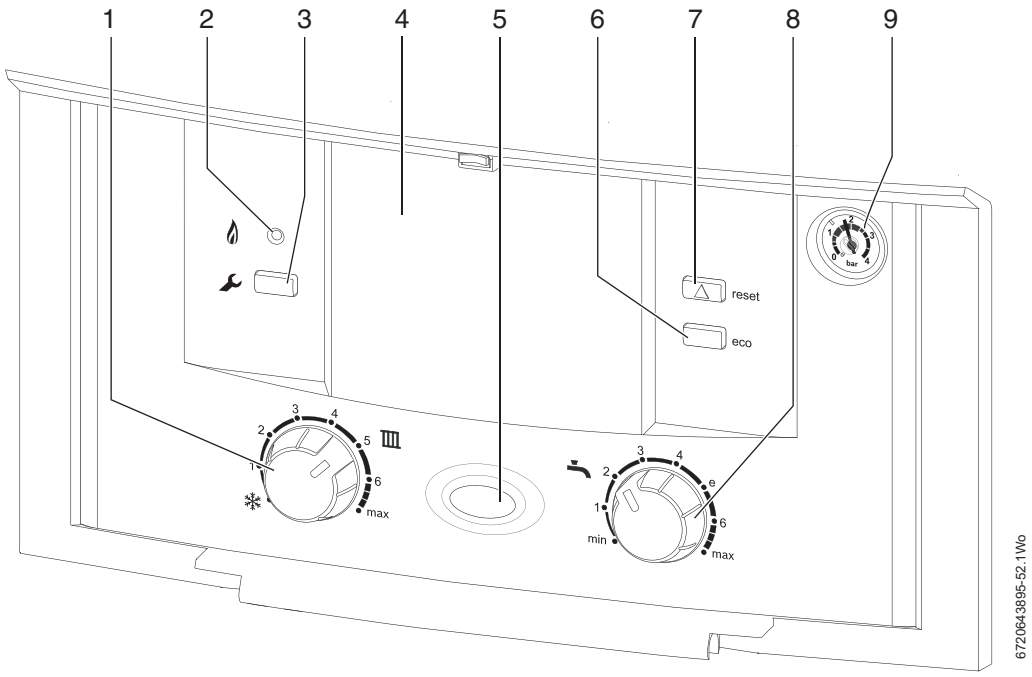


Fig. 61 Control panel

Switching the appliance on/off:

- Turn on mains power supply, the power on indicator (5) illuminates BLUE.
- Turn on any external controls
- Set the thermostatic radiator controls to maximum temperature
- Set the clock/programmer to continuously ON and the room thermostat to maximum temperature

1	Central heating temperature control
2	Burner indicator (Green)
3	Service button
4	Cover or optional Programmer
5	Power ON and fault indicator (Blue)
6	ECO button - Not used
7	Reset button
8	DHW temperature control
9	System pressure gauge

Tab. 25 Control panel legend

Turn the boiler CH temperature control (1) to maximum. The burner on indicator (2) illuminates GREEN when the burner has lit.

If the boiler fails to light, the BLUE power indicator (5) and reset button (7) will flash.

NOTICE: RESET

- Do not press the blue power indicator (5) to reset the boiler.

To reset press and hold the reset button (7) for more than two seconds. The boiler will be reset.

5.5 COMMISSIONING

NOTICE: The combustion settings on this gas-fired boiler have been checked, adjusted and preset at the factory for operation on the gas type defined on the data plate.
No measurement of the combustion values is necessary provided there is a meter installed allowing the gas rate to be checked.
DO NOT ADJUST THE AIR/GAS RATIO VALVE.

When running in the service mode, the boiler will operate both the central heating and the domestic hot water circuits. This is to allow sufficient time for this part of the commissioning procedure. It will be necessary to run water through the domestic hot water circuit to ensure that the boiler will not cycle on low heating demands.

Having checked:

- That the boiler has been installed in accordance with the installation instructions.
- The integrity of the flue system and flue seals, as described in section 6.3 of this manual.
- The integrity of the boiler combustion circuit and relevant seals.

5.5.1 CHECKING THE GAS INLET PRESSURE

The inlet pressure to the appliance must be checked using the following procedure:

MEASURING THE INLET PRESSURE

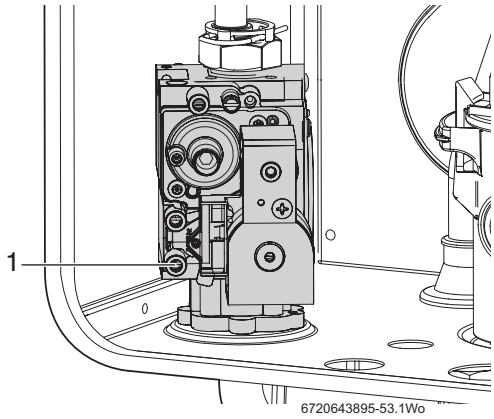


Fig. 62 Inlet pressure test point

- Close gas isolation valve.
- Slacken the screw in the inlet pressure test point (1) and connect a manometer.
- Open gas isolation valve.
- Measure the pressure with the boiler running at maximum.
  - Press service button for more than ten seconds and set Central Heating temperature to maximum.
  - The service button will illuminate continually and the blue power indicator will pulse five times.
- Check the gas supply working pressure at the gas valve conforms to values shown in Fig. 63 or Fig. 64.

Ensure inlet pressure is satisfactory with all other gas appliances working.

GAS PRESSURE WITHIN THE SYSTEM

Refer to the figures below for natural gas or L.P.G gas pressures.

The pressure at the boiler must not be less than the pressure read at the meter minus:

- 1 mbar for Natural Gas
- 2.5 mbar for L.P.G.

The pressure drop from the meter to the gas valve must not be more than:

- 2.5 mbar for Natural Gas
- 4 mbar for L.P.G.

If the pressure drops are greater than shown below, then this would indicate a problem with the pipe work or connections within the system.

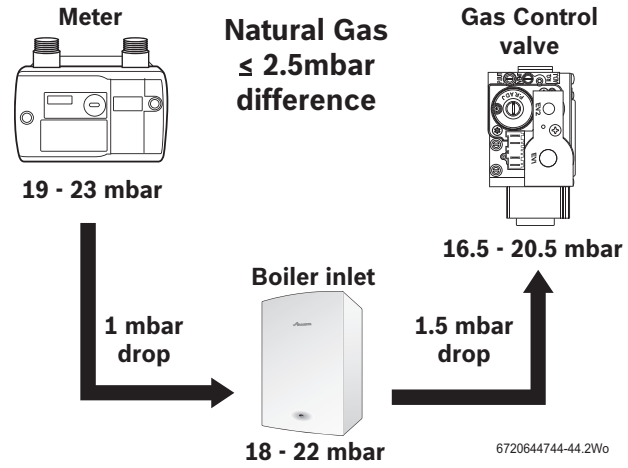


Fig. 63 Natural gas pressures

≤ Equal to or less than .....

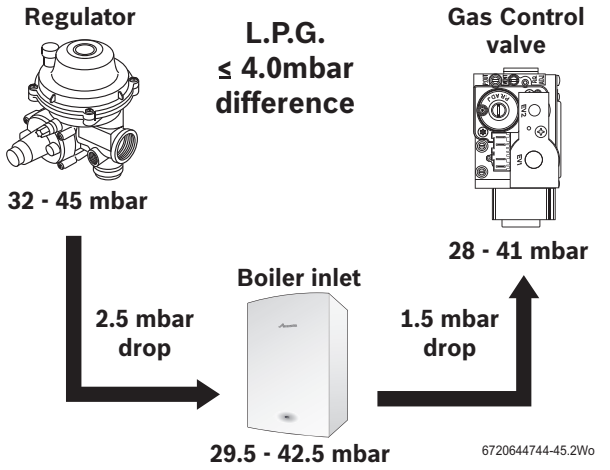


Fig. 64 L.P.G. pressures

NOTICE:
Do not continue commissioning until the correct gas pressure is achieved.

5.5.2 CHECKING THE GAS RATE

- The gas rate should be measured at the gas meter after 10 minutes operation at maximum.
  See technical data section at the front of this manual.
- Where a gas meter is not available (e.g. L.P.G.) the CO/CO_2 must be checked to the units shown in the setting of the air/gas ratio, refer to section 6.6.
- If pressure and gas rate are satisfactory press the service button again and the boiler will return to normal operation.
  - If left in the service mode the control will return to normal operation after 15 minutes.
- Close the gas isolation valve.
- Remove the manometer.
- Re-seal the screw in the gas inlet pressure test point.
- Open the gas isolation valve.
- Ensure that there are no gas leaks.
- Replace the outer case.

5.5.3 DOMESTIC HOT WATER:

Controlling the hot water temperature:

NOTICE: Domestic Hot Water

- The hot water temperature can only be controlled when the “Optional diverter valve” kit is fitted.

The hot water temperature can be set to between approximately 40°C and 60°C using the DHW temperature control.

5.6 FINISHING COMMISSIONING

5.6.1 REPLACE OUTER CASING:

- Replace outer casing making sure that the securing points are properly located.
- Replace top two screws (1).
- Tighten bottom two screws (2).

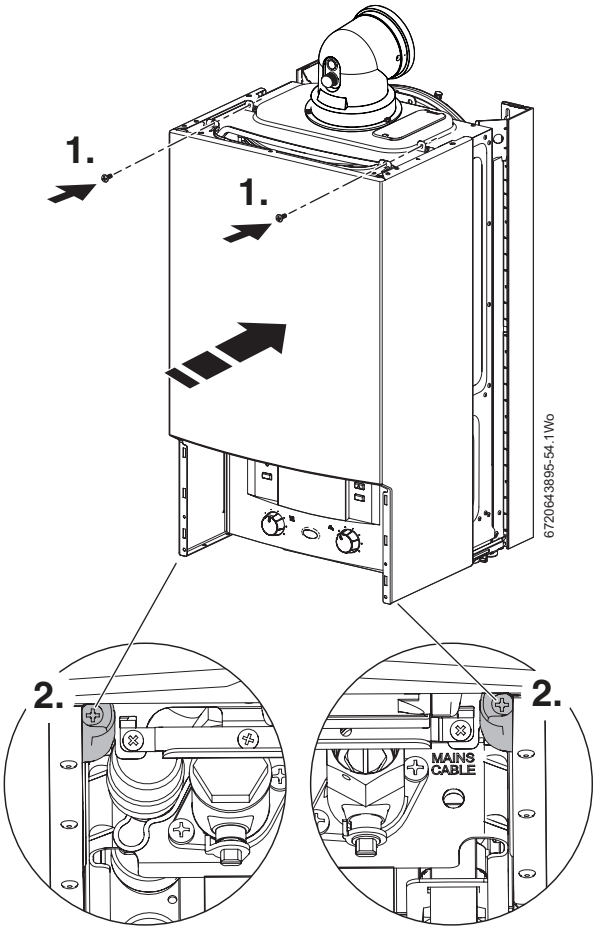


Fig. 65 Fitting case

5.6.2 FITTING FASCIA FLAP

- Present the flap up to the appliance with the hinge pins facing the appliance.
- Engage the left hand pin into the grey pivot. The hinge pin and pivot hole are both square, rotate the flap to ensure that the pin is located in the pivot.
- Support the flap in your left hand and with your right hand, bend the right side down. This should enable you to engage the right hand pin in the pivot. Rotate the flap to ensure that the pins and pivots are located securely.
- Close the flap.

5.6.3 INSTALLING BOTTOM PANEL

- The bottom panel slides onto two ledges (C) either side of the boiler frame.
- Hold the panel up against the underside of the boiler and slide towards the rear, until there is no more movement.
- Slide the panel forward until it is fully engaged.

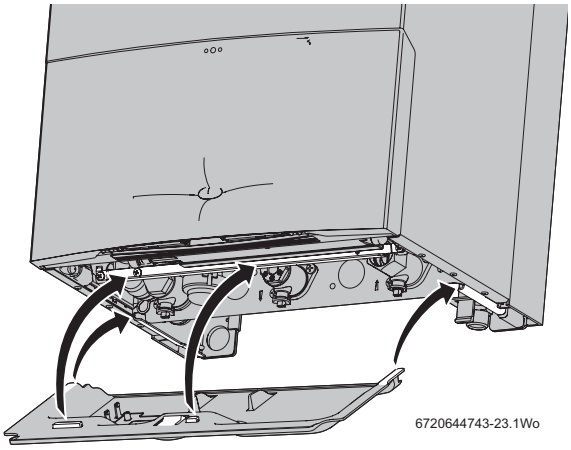


Fig. 66 Bottom panel installation

NOTICE: Every time the power to the appliance is turned off and on, the appliance enters a learning mode and may take some time to optimise the boiler performance. This time is variable and is dependant on hot water and central heating demand.

5.6.4 HAND OVER

- Complete the Benchmark Gas Boiler Commissioning Checklist.

The Benchmark Checklist can be found at the rear of these instructions.

- Open the fascia cover by gently pressing the centre top of the cover.
- Set up the controls and show the user how to operate all the controls shown in the User Guide.
- Ensure that the user guide is left with the boiler or homeowner.
- If the appliance is unused and exposed to freezing conditions, shut off all the mains supplies and drain the system and boiler.

6 SERVICE AND SPARES

6.1 INSPECTION AND SERVICE

CAUTION: TURN OFF THE GAS SUPPLY AND ISOLATE THE MAINS SUPPLIES BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

NOTICE: COMPONENTS.

- After replacement of any components always check for gas tightness where relevant and carry out functional checks as described in Commissioning. Damaged O-rings or gaskets must be replaced.

NOTICE: Service work must be carried out by a competent registered engineer, such as British Gas or Gas Safe registered personnel!

NOTICE: SERVICE MUST **NOT** BE ATTEMPTED IF A CO/CO_2 ANALYSER IS **NOT** AVAILABLE.

- To ensure the continued efficient operation of the appliance it must be checked at regular intervals.
- The frequency of servicing will depend upon the particular installation conditions and usage however, an annual service is recommended.
- The extent of the service required by the appliance is determined by the operating condition of the appliance when tested by fully qualified engineers.
- The service interval record sheet at the rear of these instructions must be completed after each service.

INSPECTION

1. Check that the terminal and the terminal guard, if fitted, are clear and undamaged.
2. If the appliance is in a compartment or cupboard check that the specified service space around the appliance is clear.
3. Check all the joints and connections in the system and remake any that show signs of leakage. Refill and re-pressurise if applicable as described in Commissioning.
4. Operate the appliance and take note of any irregularities.
   Refer to Fault Finding for rectification procedures.

COMPONENT ACCESS

1. Removing outer case
   - Remove bottom panel by pushing it fully back and then pulling it forward and down to remove.
   - Undo and remove two screws (1) securing boiler casing at the top of the appliance.
   - Undo but do not remove the two screws (2).
   - Pull case forward and remove.

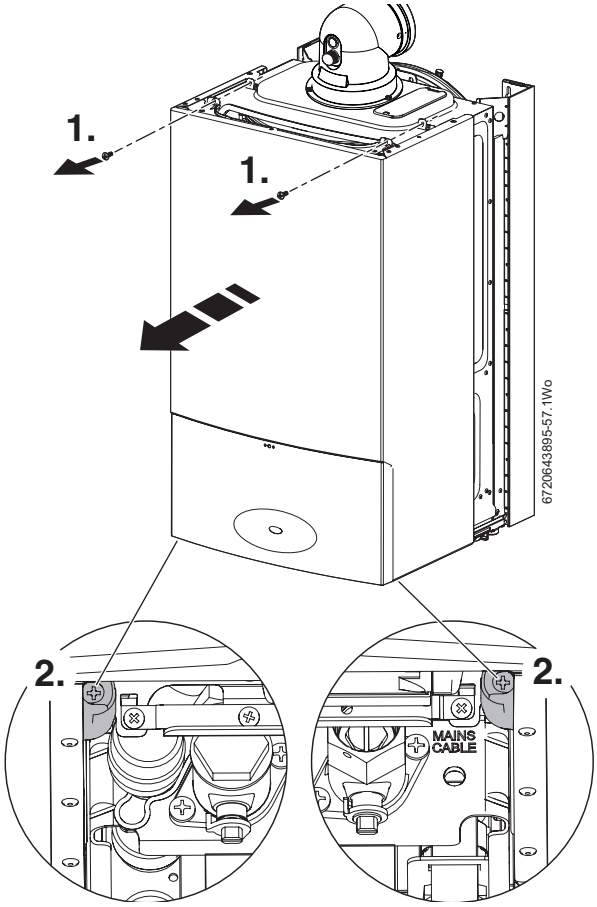


Fig. 67 Remove outer case

2. Lowering boiler control to the service position:
   - Remove screw (1) securing the control panel.
   - Pull the panel (2) forward into the service position.

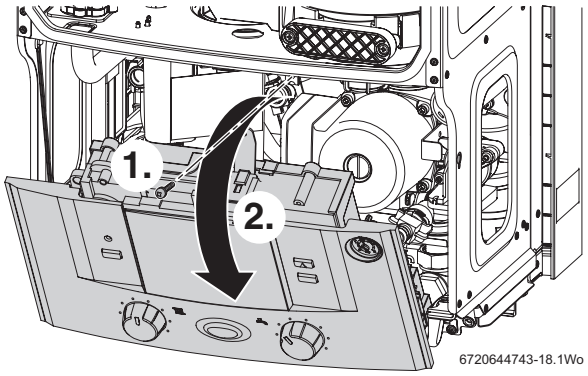


Fig. 68 Control panel into service position

6.2 CHECK THE GAS INLET PRESSURE

Refer to section 5.5.1 for more information

NOTICE:

- Ensure that the gas inlet pressure is satisfactory with all other gas appliances working.
- Do not continue with the other checks if the correct gas inlet pressure can not be achieved.

- Check the gas supply working pressures in the system conform to the readings shown in the table below:

Natural gas				
	Allowed mbar pressure drop			
meter/ regulator	across pipework	boiler inlet	across boiler	gas control valve
19 - 23	1	18-22	1.5	16.5 - 20.5
L.P.G.				
32 - 45	2.5	29.5 - 42.5	1.5	28 - 41
mbar range				

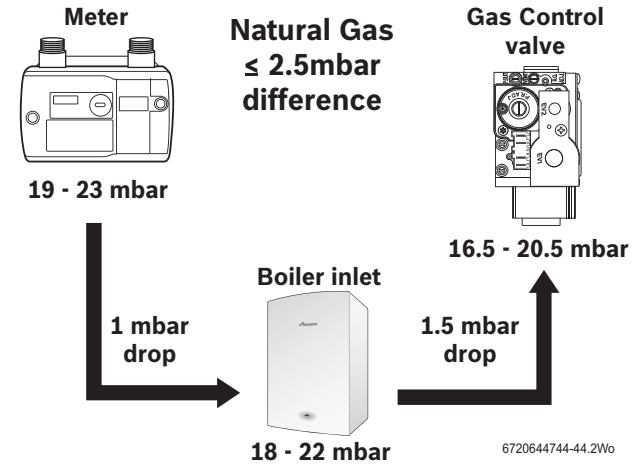


Fig. 69 Natural gas pressures

≤	Equal to or less than .....

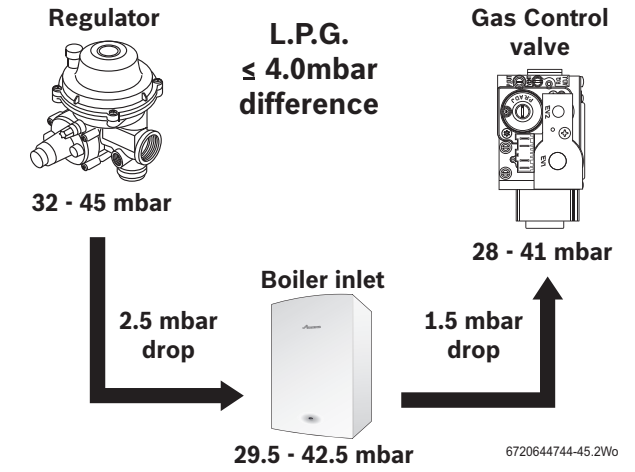


Fig. 70 L.P.G. pressures

6.3 CHECKING FLUE INTEGRITY

The integrity of the flue system and performance of the boiler can be checked via the flue turret sample points.

Flue gas sample point	1
Air inlet sample point	2

Tab. 26 Key to figure 71

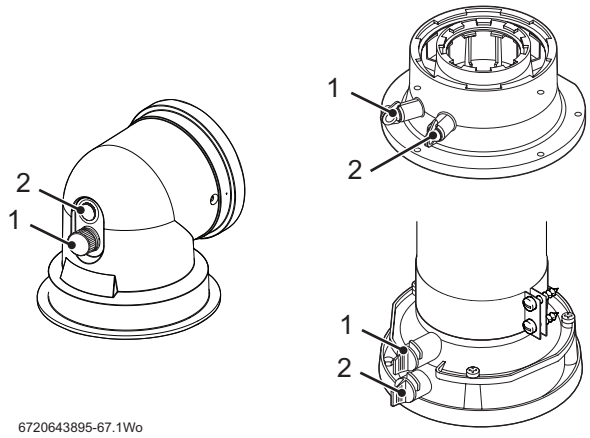


Fig. 71 Flue test points

- With the boiler case on and the boiler running at maximum.
- Insert the analyser probe into the air intake test point.
- Allow the readings to stabilise and check that:
  - O_2 is equal to, or greater than 20.6%
  - CO_2 is less than 0.2%
- If the readings are outside these limits then this indicates that there is a problem with the flue system or combustion circuit.

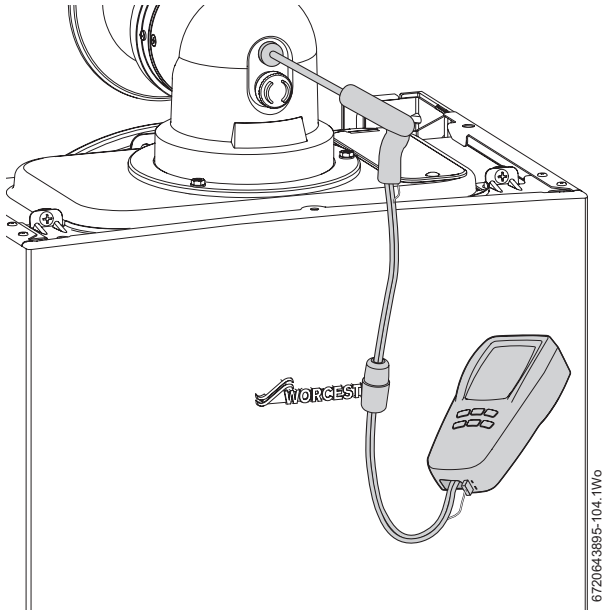


Fig. 72 Flue integrity test

6.4 FAN PRESSURE TEST

This test is to determine if the heat cell requires cleaning/attention.

SETTING THE BOILER TO MAXIMUM

1. Press and HOLD service button for more than 10 seconds
2. Set the Central Heating temperature to maximum.
   - The service button will illuminate continually and the blue power indicator will pulse 5 times.
   - The boiler will stay in this mode for 15 minutes unless the service button is pressed again.

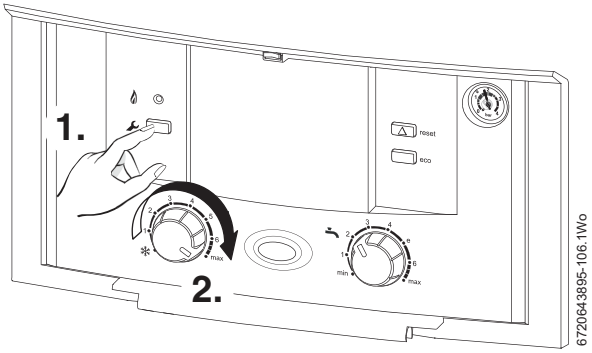


Fig. 73 Set boiler to maximum

FAN PRESSURE

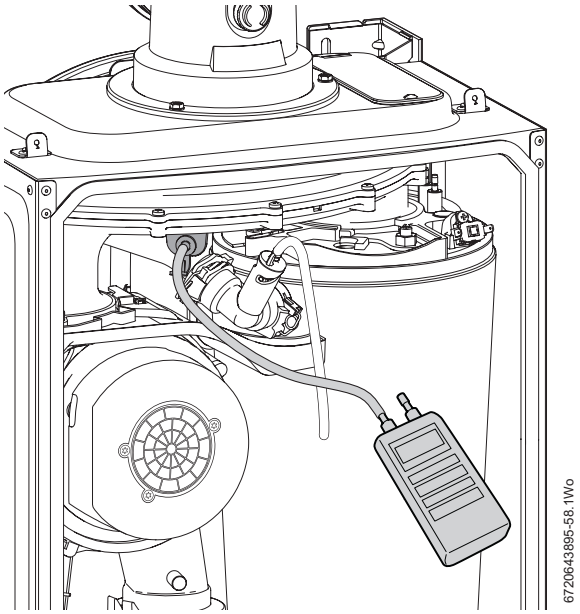


Fig. 74 Fan pressure test point

- Remove the cover and connect a digital manometer to the fan pressure test point.
- After measurement replace test point cover.
- The pressure will read negative, refer to the chart in figure 75.

NOTICE:
The boiler must be run at maximum output for Fan Pressure test and the Flue Gas analysis.

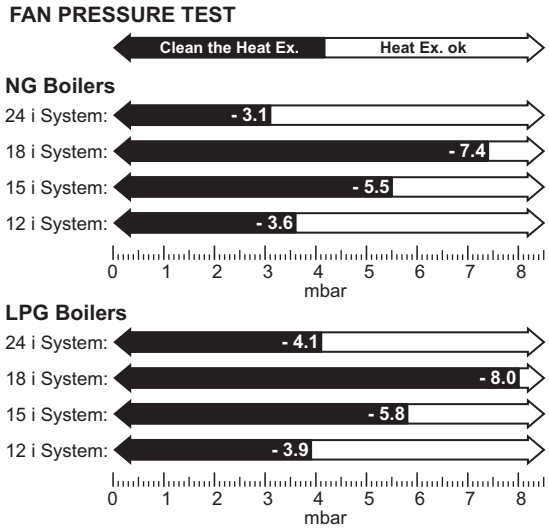

FAN PRESSURE TEST
Clean the Heat Ex.
Heat Ex. ok
NG Boilers
24 i System: - 3.1
18 i System: - 7.4
15 i System: - 5.5
12 i System: - 3.6
0 1 2 3 4 5 6 7 8
mbar
LPG Boilers
24 i System: - 4.1
18 i System: - 8.0
15 i System: - 5.8
12 i System: - 3.9
0 1 2 3 4 5 6 7 8
mbar

Fig. 75 Fan pressure readings

If the boiler fails the fan pressure test then before adjusting the air/gas ratio, try the following:

- Check the syphon is not blocked.

1. Remove the screws securing the sump cover.
2. Remove the sump cover.
3. Clean the sump and heat exchanger with a suitable brush

- Check the exhaust path and flue for restriction.
- Re-check the Fan Pressure readings

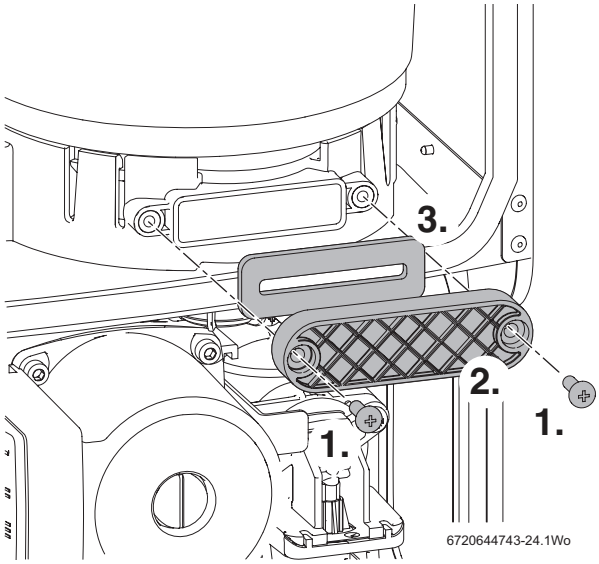


Fig. 76 Sump access

6.5 FLUE GAS ANALYSIS

COMBUSTION TEST:

- Connect the flue gas analyser to the flue gas sampling point as shown in the figure below.
- Run the boiler at maximum output for at least 10 minutes.
- Check the CO/CO_2 readings against the information in table 27 CO/CO_2 settings.

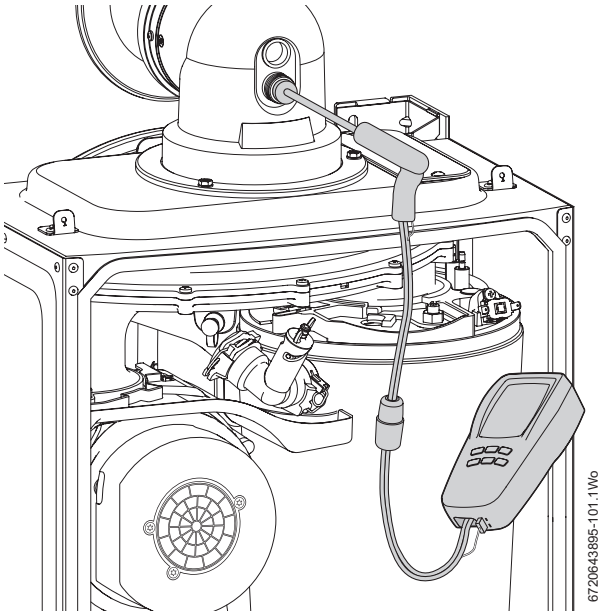


Fig. 77 Combustion test

If the boiler fails the combustion test, check:

1. Air intake for restriction
2. Diaphragm in the fan, for correct operation
3. Cleanliness of the heat cell, plus blockages in the condensate disposal

6.6 SETTING THE AIR/GAS RATIO

NOTICE: THE SETTING OF THE GAS RATIO MUST BE CARRIED OUT BY A COMPETENT PERSON. SETTING OF THE GAS RATIO MUST NOT BE ATTEMPTED UNLESS THE PERSON CARRYING OUT THE TEST IS EQUIPPED WITH A COMBUSTION ANALYSER CONFORMING TO BS 7927 AND IS COMPETENT IN ITS USE.

6.6.1 SETTING THE CO/CO_2

When running in the service mode, the boiler will operate both the central heating and DHW circuits. This is to allow sufficient time for the setting procedure. It will be necessary to run sufficient water through the DHW circuit to ensure that the boiler will not cycle on low heating demands.

- Refer to section 5.6.1 and ensure that the gas inlet pressure is correct before continuing.
- To adjust the CO/CO_2 it will be necessary to first operate the boiler at maximum output.

1. Press and hold down the service button for more than 10 seconds until illuminated.
   The blue power indicator will pulse 5 times.
2. Turn central heating control to maximum; the boiler will then go to maximum output.

The control will resume normal operation after 15 minutes or if the service button is pressed for more than a second.

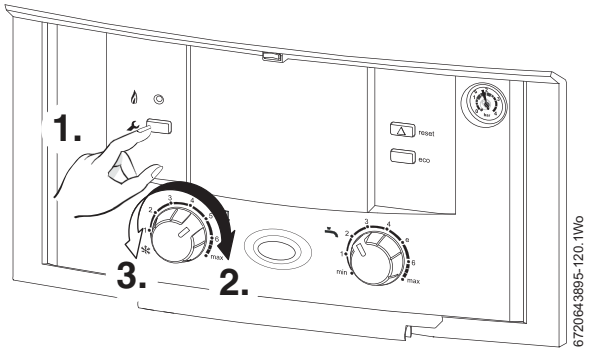


Fig. 78 Setting the boiler

- Refer to table 27 and check the CO/CO_2 at maximum. If required set the maximum CO/CO_2 via adjuster (1) on the gas valve using a 2.5mm Allen key.
- Check CO is less than 200ppm.

3. Set the central heating control to minimum.

- The boiler will go to minimum power.
- Measure the CO/CO_2 and check against table 27 below.
  If required set the minimum CO/CO_2 via adjuster (2) on the gas valve until the correct measurement is set:
  - Remove dust cap with flat bladed screw driver.
  - Using a 4mm Allen key adjust CO_2.
  - Replace the dust cap.
- Check that the CO is less than 200ppm.
- Return to maximum and re-check the CO/CO_2.
  If correct, press the service button;
  the button will cease to be illuminated and the blue power indicator will be permanently illuminated.
- Re-assemble and refit boiler case.

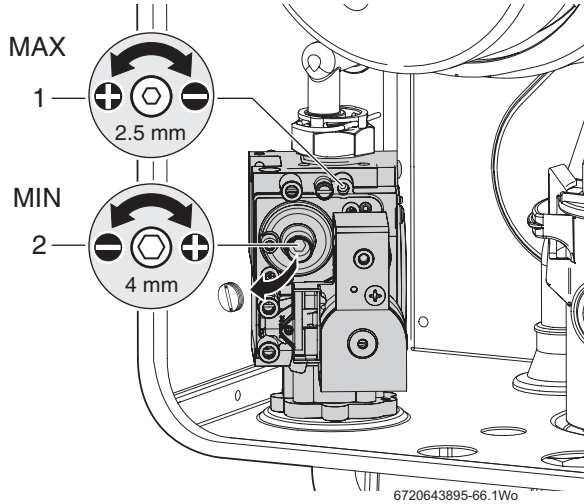


Fig. 79 Gas valve adjustment

CO/CO_2 settings for Greenstar i System **CO/CO_2 should be measured after 10 minutes.**		
Gas type	CO_2 max.	CO_2 min.
Natural gas 12i System	9.65% ± 0.5	8.65% ± 0.5
Natural gas 15,18 & 24i System	9.8% ± 0.5	9.2% ± 0.5
L.P.G.	11.0% ± 0.5	10.5% ± 0.5
NOTE: When checking an existing appliance the tolerance is ± 0.5. If checking after cleaning or component replacement or for adjustment when the reading obtained is outside the tolerances given above, then the tolerance is ± 0.2.		
CO - less than 200 ppm (0.002 ratio)		

Tab. 27 CO/CO_2 settings

6.7 CLEANING THE HEAT EXCHANGER

NOTICE: COMBUSTION TESTING

- Combustion testing must be carried out by a competent person. Testing must not be attempted unless the person carrying out the combustion check is equipped with a Combustion Analyser conforming to BS 7927 and is competent in its use.

NOTICE: CO/CO_2 CHECKS

- If the joint between the Air/Gas manifold and heat exchanger is disturbed sealing gasket must be replaced.
- After completing the service of the appliance, the CO/CO_2 must be checked and set to the limits shown in “Setting the air/gas ratio” on page 46.

There is a special accessory kit available specifically designed for cleaning the heat exchanger. If required order 7 716 192 312.

- Isolate the power to the appliance and remove outer case and base panel.

1. Refer to figure 80 and remove the clip from gas valve outlet.

If the plastic elbow can not be easily removed, undo the nut to push the plastic elbow out of the fitting.

2. Pull the gas outlet elbow free from the gas valve.

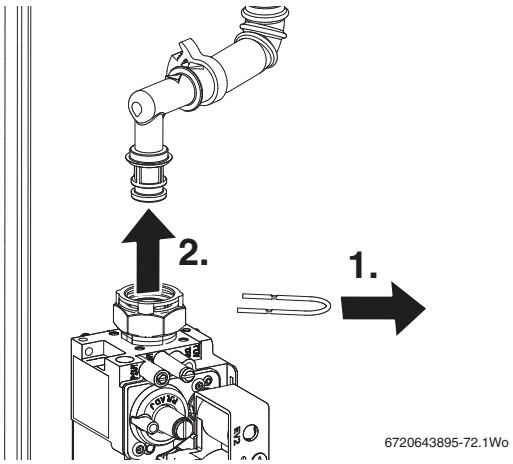


Fig. 80 Gas valve connection

- Remove electrical connector and earth wire from fan.

To prevent damage to the electrodes when removing the air/gas manifold, disconnect the leads to the electrodes.

- Disconnect spark electrode and flame sensor connections.

1. Refer to figure 81 and undo the securing nut on the top of the heat exchanger and remove the retaining plate assembly.

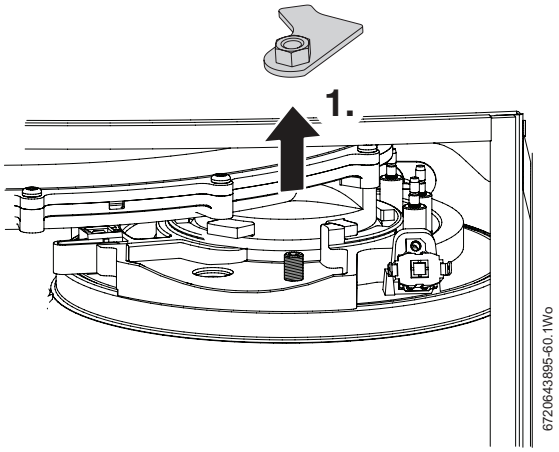


Fig. 81 Securing nut

1. Refer to figure 82 and rotate fan and air/gas manifold assembly around the top of the heat exchanger until it stops at the lug.

- Lift up assembly and remove from boiler.

2. Remove the cover panel by removing retaining screw.

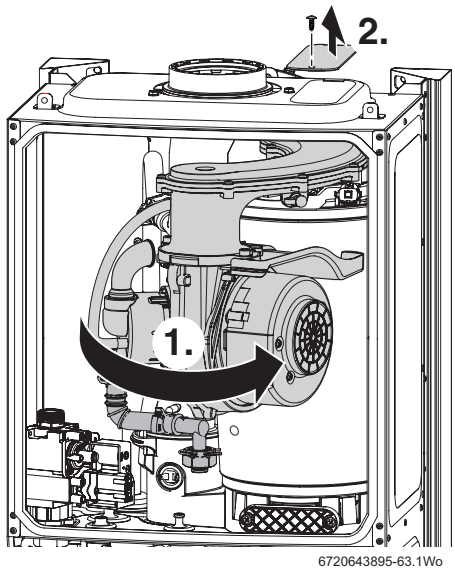


Fig. 82 Rotate air/gas manifold

BURNER REMOVAL

Refer to figure 83

1. Remove clamping plate.
2. Remove spark/flame electrode assembly and seal from the top of the heat exchanger.
3. Remove burner.

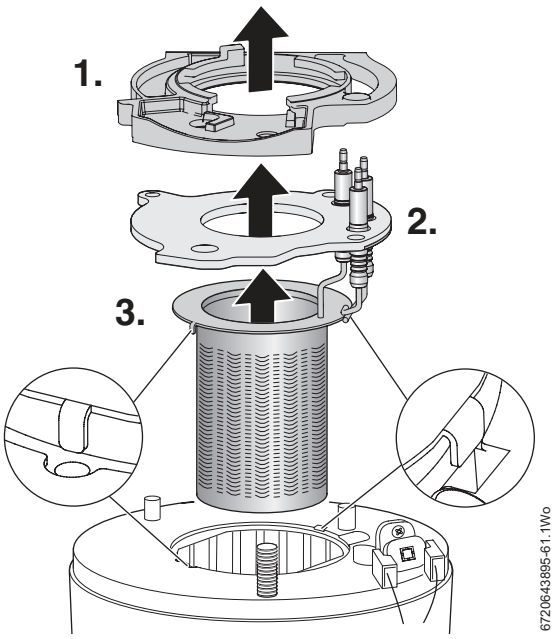


Fig. 83 Burner removal

Checking and cleaning the electrode assembly:

NOTICE: Cleaning

- Do not use wire wool to clean the electrodes

- Inspect the condition of the electrodes and ceramics, replace if necessary.
- Use a plastic scouring pad to clean the electrodes.

BAFFLE REMOVAL

Refer to figure 84.

1. Remove top baffle.
2. Remove lower baffle.

If the lower baffle is stuck, it may be necessary to use the “Baffle removal tool” from the heat exchanger cleaning kit - 7 716 192 312, as shown in figure 84.

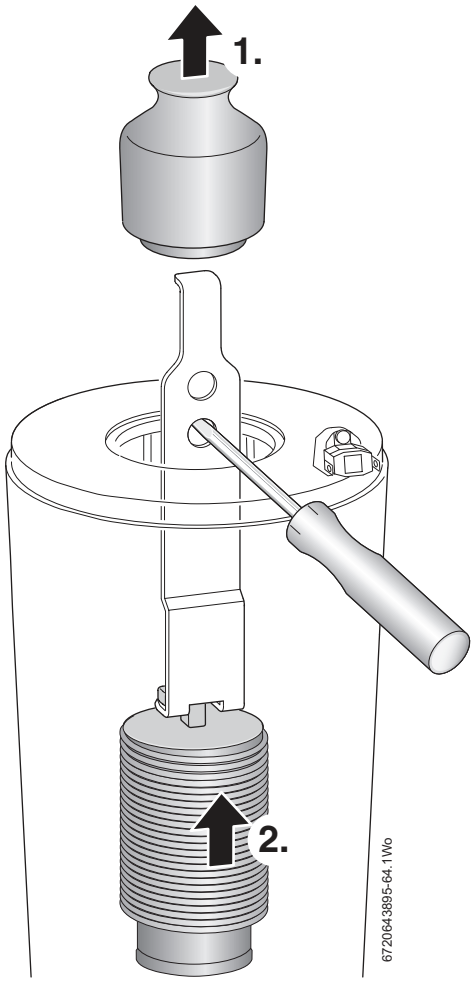


Fig. 84 Baffle removal

ACCESS COVER REMOVAL

Refer to figure 85.

1. Remove the two pozi-drive screws
2. Remove the access cover
3. Remove the gasket.

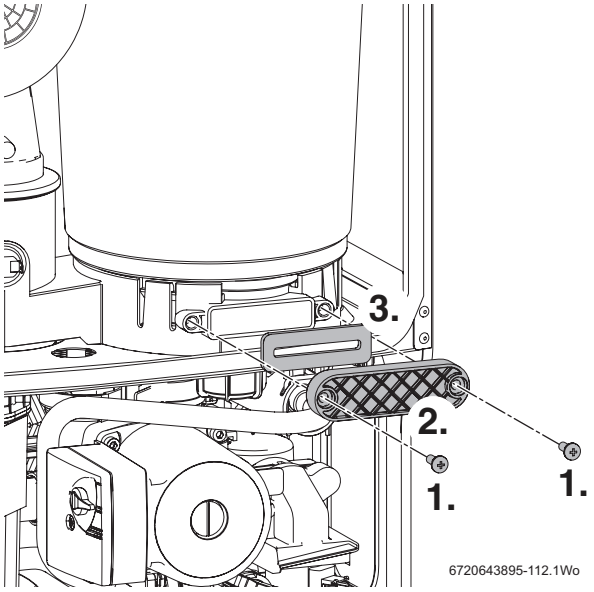


Fig. 85 Access cover removal

CLEANING THE PRIMARY HEAT EXCHANGER

Refer to figure 86.

- Access the heat exchanger flue ways by inserting the cleaning brush (7 716 192 312) through the top access hole in the casing, removal of panel shown in figure 82.
- Clean heat exchanger flue ways using the cleaning brush removing any debris from the access point in the sump.
- Clean around the sealing surface on the sump.
- Replace the access cover.
- Using a suitable container to collect water from syphon connection at the base of the boiler flush heat exchanger with water.
- Re-assemble ensuring that the lower baffle (2) and the top baffle (1) are refitted correctly.
- Refer to figure 83 when re-fitting the burner to ensure that it fits centrally within the heat exchanger and location tabs are situated in location holes.
- Ensure that the seal is replaced with a new seal and ensure that the seal is correctly fitted.
- Check the syphon unit is clean before refitting to boiler.
- Reassemble and check combustion as stated in “SETTING THE AIR/GAS RATIO” section on page 46.

THE HEAT EXCHANGER DOES NOT HAVE TO BE REMOVED TO CLEAN.
The heat exchanger is shown removed from the boiler to illustrate cleaning more clearly.

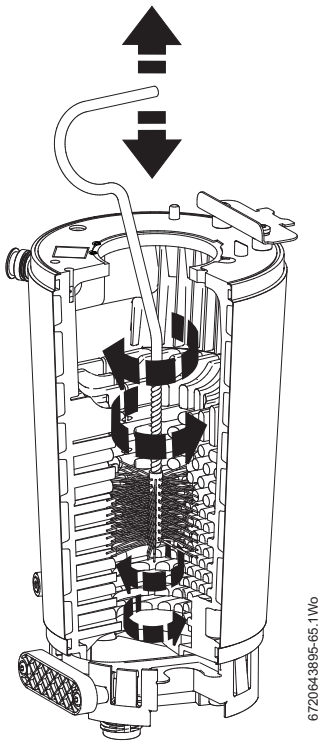


Fig. 86 Cleaning heat exchanger

NOTICE: Heat exchanger baffles.
The baffles (1) and (2) must be refitted into the heat exchanger in the order shown in figure 84. Failure to do so may result in damage to the boiler.

NOTICE: CO/CO_2 CHECKS

- If the joint between the Air/Gas manifold and heat exchanger is disturbed sealing gasket must be replaced.
- After completing the service of the appliance, the CO/CO_2 must be checked and set to the limits shown in “Setting the air/gas ratio” on page 46.
- When replacing the burner gasket ensure that the clamping plate is fully tightened down to the heat exchanger.

CLEANING THE SYPHON

There is no need to remove the Syphon to clean.
To drain debris from the syphon, release the clips and remove the drainage cap from the bottom of the syphon.
Catch the debris and condensate from the syphon into a suitable container.

6.8 REPLACEMENT OF PARTS

CAUTION: TURN OFF THE GAS SUPPLY AND ISOLATE THE MAINS SUPPLIES BEFORE STARTING ANY WORK AND OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

NOTICE: REPLACEMENT OF COMPONENTS.

- After replacement of any components always check for gas tightness where relevant and carry out functional checks as described in Commissioning. Damaged O-rings or gaskets must be replaced.

6.8.1 REMOVING OUTER CASE

1. Undo the two screws securing the top of the boiler casing.
2. Undo the two screws securing the bottom of the boiler casing.

- Pull case forward and remove.
  To remove bottom tray, pull forward on the tag on the underside of the tray.

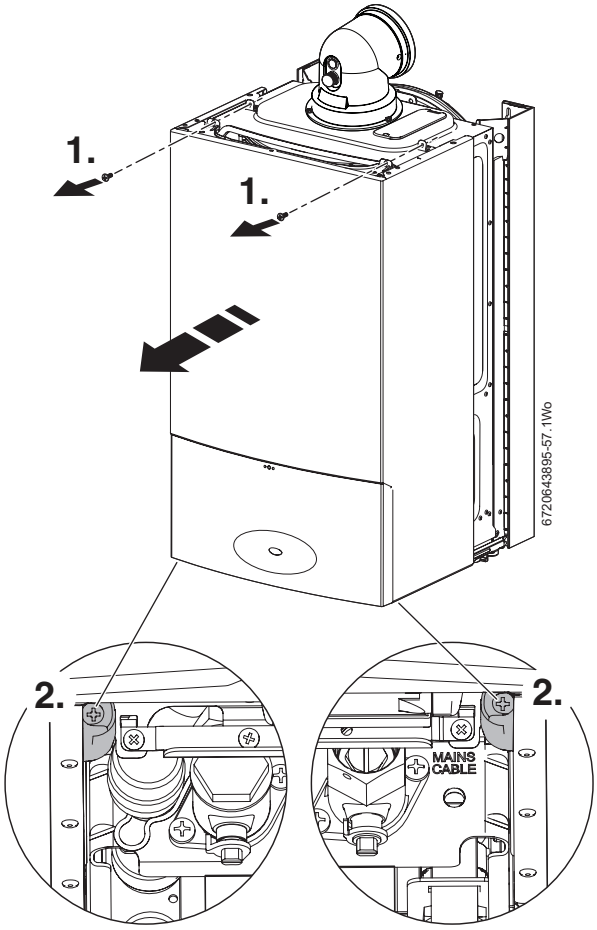


Fig. 87 Remove outer case

To gain access to the following components he outer case has to be removed:

- Primary sensor
- Overheat thermostat
- Flue limit thermostat

6.8.2 PRIMARY SENSOR

Refer to figure 88 for removal.

1. Remove electrical connection by pulling upwards. Squeeze retaining clip on plastic moulding of sensor and pull back and up until clear of pocket in heat exchanger.
2. Pull forward to remove completely.

- Coat new sensor with heat conductive paste and replace.

6.8.3 OVERHEAT THERMOSTAT

Refer to figure 88 for removal.

- Remove two electrical connectors from thermostat.

3. Slacken and remove fixing screw and thermostat (3).

- When replacing ensure thermostat sits correctly on surface of the casting with the left hand side of thermostat sitting up against the shoulder.

It is essential that the mating surface of the thermostat is coated with heat conductive paste.

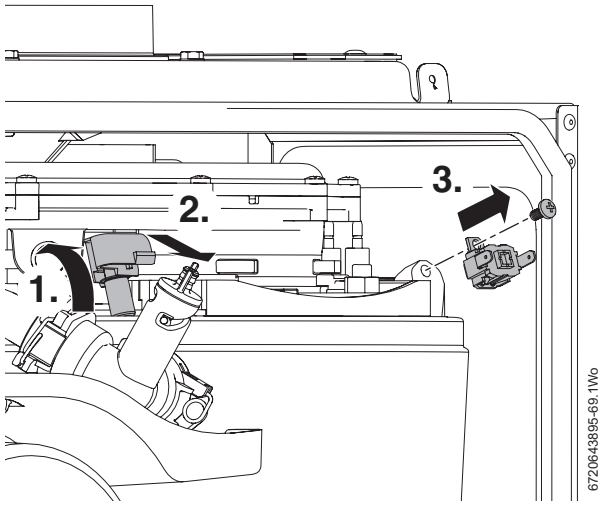


Fig. 88 Primary sensor and overheat thermostat

6.8.4 FLUE OVERHEAT THERMOSTAT (WITH GROMMET)

To remove and replace the thermostat either:

- Using a small terminal screwdriver, prise the thermostat and grommet from the plastic housing. Take care not to damage the grommet or plastic housing.

-or-

1. Release the flue connection from the sump.
2. Push the flue tube up.

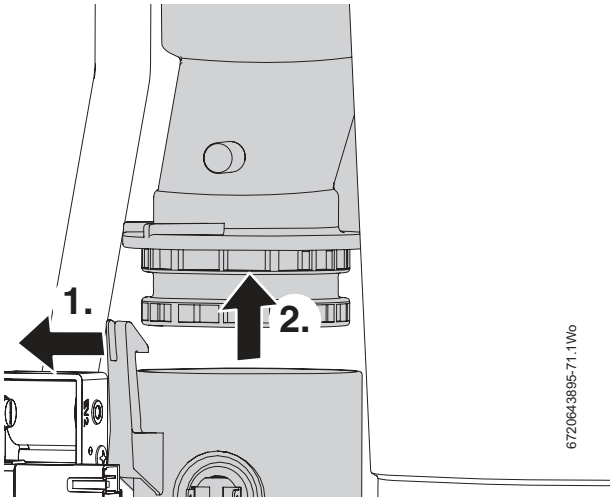


Fig. 89 Lower exhaust section

- Remove electrical connections.
- Push the flue limit thermostat in from the sump.
- Retrieve the thermostat from the sump well.

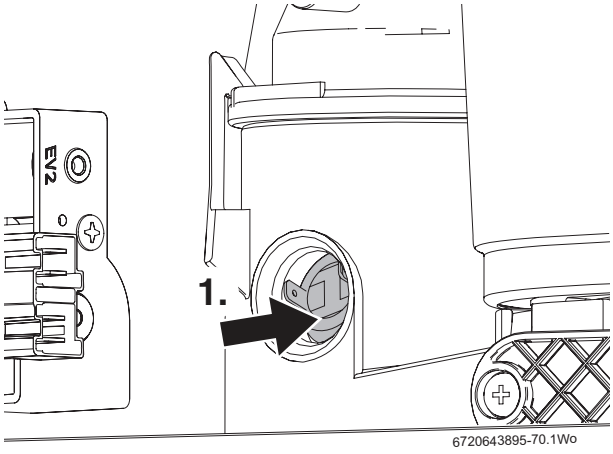


Fig. 90 Remove thermostat

To replace, push the thermostat and grommet gently back into the opening until contact with the locating ridge is felt.

6.8.5 MOVING CONTROLS TO SERVICE POSITION

To remove the following components require the control box must be moved in to the service position:

- Gas valve
- Syphon
- PCB
- Fuse
- Transformer

NOTICE: REPLACEMENT OF THE GAS VALVE MUST NOT BE CARRIED OUT IF A CO/CO_2 ANALYSER IS NOT AVAILABLE.

1. Remove the screw securing control panel.
2. Gently pull the panel forward.

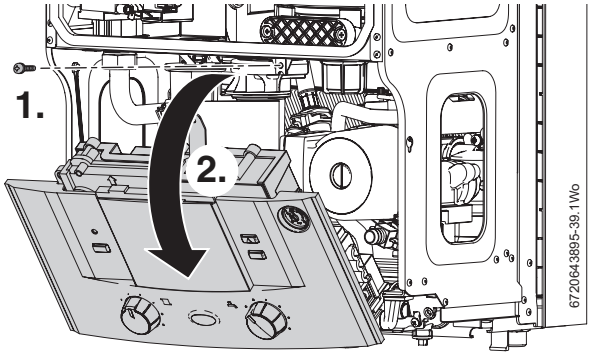


Fig. 91 Control panel to service position

6.8.6 GAS VALVE

Refer to figure 92

- Isolate gas supply at boiler gas cock.

1. Remove wire clip from the gas valve outlet.
2. Pull the gas pipe free from the gas valve.
   If the pipe will not pull out, unscrew the nut to aid removal.

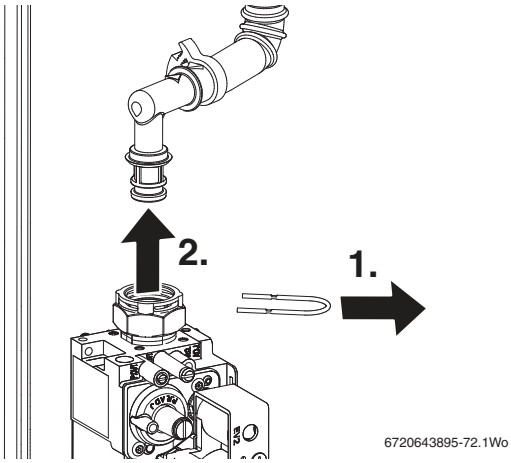


Fig. 92 Gas valve upper connection

Refer to figure 93

1. Undo bottom gas connection to gas valve.
2. Undo two securing screws on the underside of casing.

- Disconnect electrical connections.
- Pull valve up and forward out of boiler.
- Replace valve with new seals and check for gas tightness.

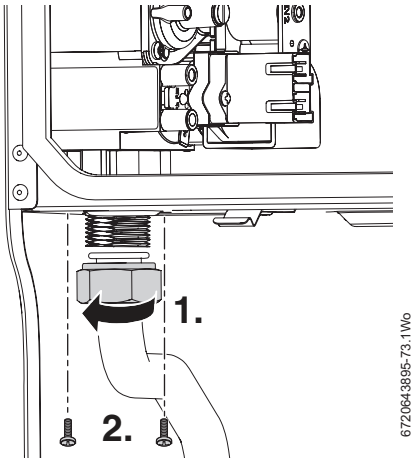


Fig. 93 Gas valve lower connection

NOTICE: The valve will require setting; follow procedure “Setting the air/gas ratio”.

6.8.7 AIR/GAS MANIFOLD AND FAN ASSEMBLY

The following components require the air/gas manifold and fan assembly to be removed:

- Fan electrode assembly
- Burner
- Heat exchanger

NOTICE:

- If the joint between the Air/Gas manifold and heat exchanger is disturbed sealing gasket must be replaced.
- After re-assembly the combustion must be checked using the procedure in the section “Setting the Air/Gas ratio”. Measurement and setting (if necessary) of the gas ratio must not be attempted unless the person is equipped with a combustion analyser conforming to BS 7927 and is competent in its use.

- Remove electrical connector and earth wire the from fan.
- Remove wire clip from gas valve outlet then pull gas pipe free from the gas valve (see figure 92).

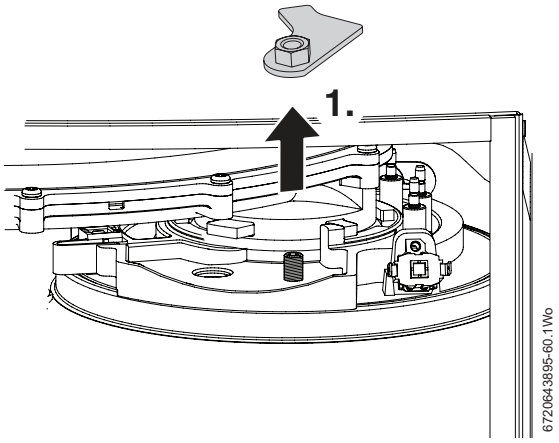


Fig. 94

- Undo the securing nut at the top of the heat exchanger and remove the retaining plate assembly (1).

Disconnect spark electrodes and flame sensor connection.
This will prevent damage to the electrodes and sensor when the air/gas manifold is rotated.

- Rotate fan and air/gas manifold assembly (1.) around the top of the heat exchanger until the lug on the air/gas manifold is visible.

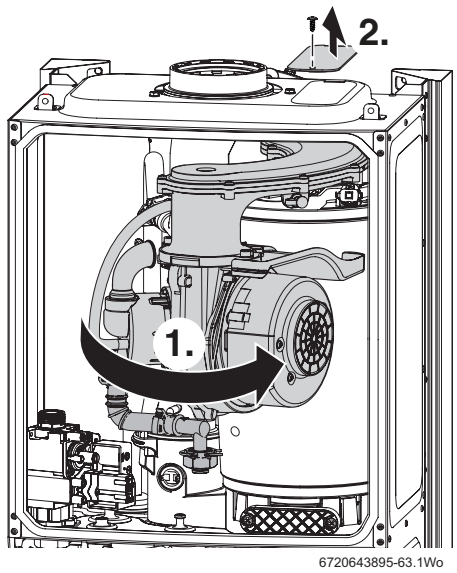


Fig. 95 Rotate the air/gas manifold assembly

- Lift up assembly and remove from boiler.

NOTICE: After re-assembly, check the CO/CO_2 levels as described in section 6.6 Setting the air/gas ratio.

6.8.8 FAN

- Remove the air/gas manifold from the boiler as described in the previous section.

1. Remove two screws retaining the fan to the air/gas manifold.
2. Remove the air/gas manifold.
3. Remove the screw holding the retaining plate.
4. Remove the retaining plate.
5. Remove three screws and the mixing chamber.

Re-assemble with new fan ensuring seals are correctly fitted.

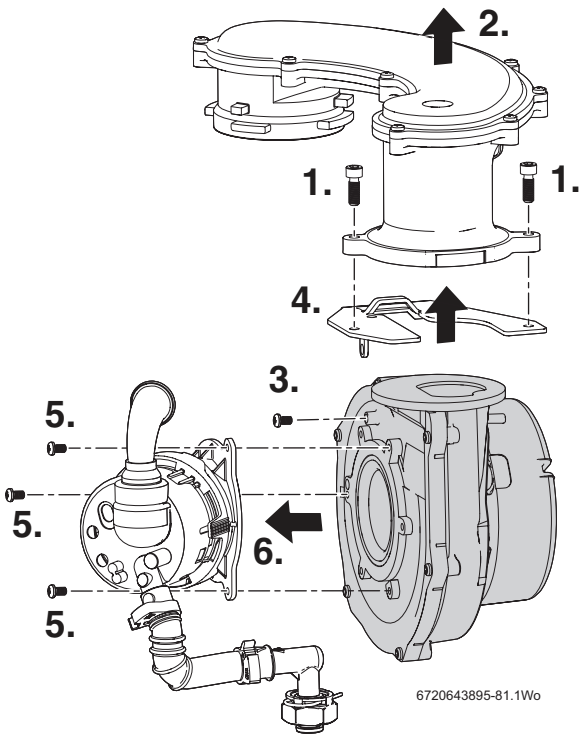


Fig. 96 Dismantling the air/gas manifold assembly

FLAP VALVE ASSEMBLY

1. Twist the mounting flange clockwise to release.
2. Pull mounting flange off the flap valve assembly.
3. Pull rubber flap off flap valve assembly.

- To replace the flap valve:
  - Press the two lugs on the back of the flap into the two slots in the flap valve assembly.

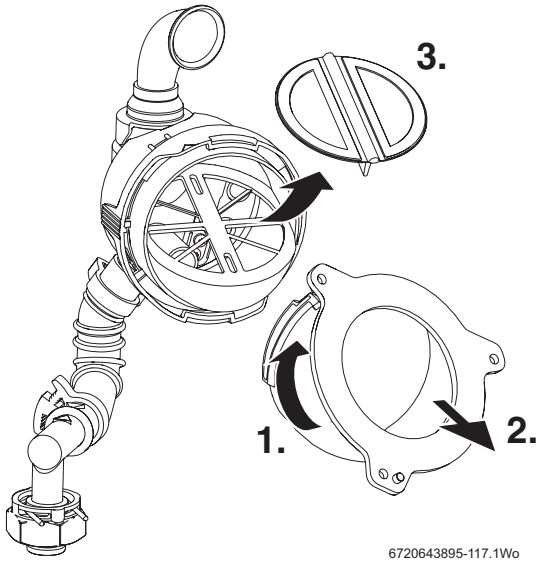


Fig. 97 Flap valve assembly

6.8.9 ELECTRODE ASSEMBLY AND BURNER

Refer to figure 98.

- ▸ Disconnect spark electrodes and flame sensor connection.
- ▸ Remove clamping plate.

1. Remove spark/flame electrode assembly from heat exchanger.
2. Remove the seal from the top of the heat exchanger.
3. Remove the burner.

- ▸ Replace new burner in correct position.
- ▸ Ensure that burner tabs, as shown in figure 98, fit correctly their respective locations.

NOTICE: Heat exchanger seal

- ▸ If the joint between the Air/Gas manifold and heat exchanger is disturbed sealing gasket must be replaced.
- ▸ After re-assembly the combustion must be checked using the procedure in the section 6.6 “Setting the Air/Gas ratio”.

- ▸ Ensure that the seal is fitted.

CAUTION: Clamping plate

- ▸ Ensure that the clamping plate is firmly tightened down on top of the heat exchanger.

- ▸ Replace the clamping plate.

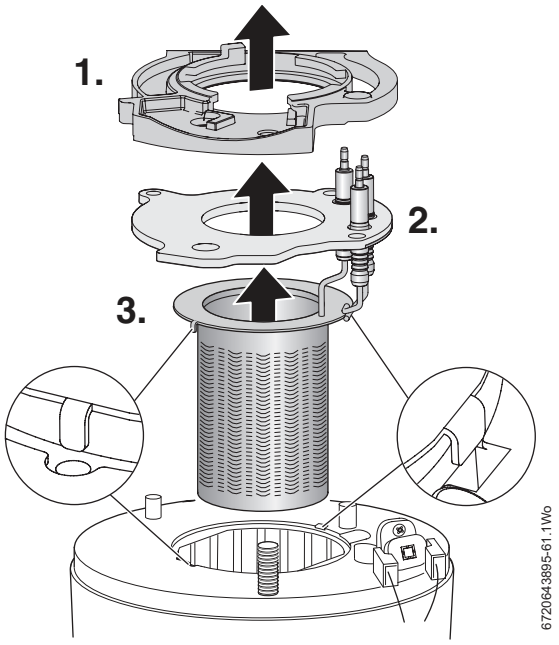


Fig. 98 Electrode assembly and burner

6.8.10 HEAT EXCHANGER

- ▸ Isolate flow and return valves then drain the boiler.
- ▸ Remove syphon.

Refer to figure 99.

1. Remove the clip from plastic elbow on the flow pipe.
2. Pull flow pipe away from heat exchanger.

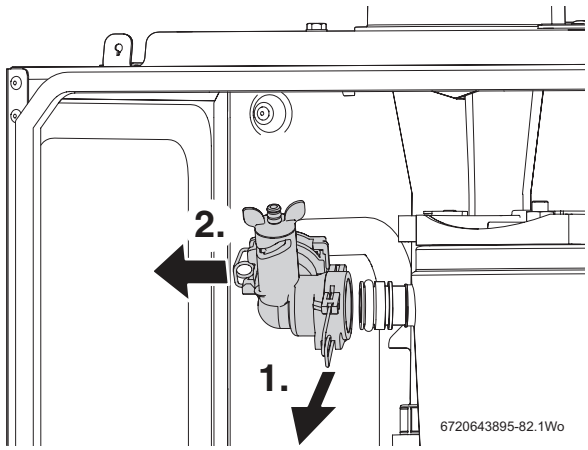


Fig. 99 Flow pipe removal

Refer to figure 100

1. Remove the three screws securing the turret to the top of the boiler.
2. Turn the upper exhaust connector clockwise to release from the hook.
3. Pull the upper exhaust connector down.

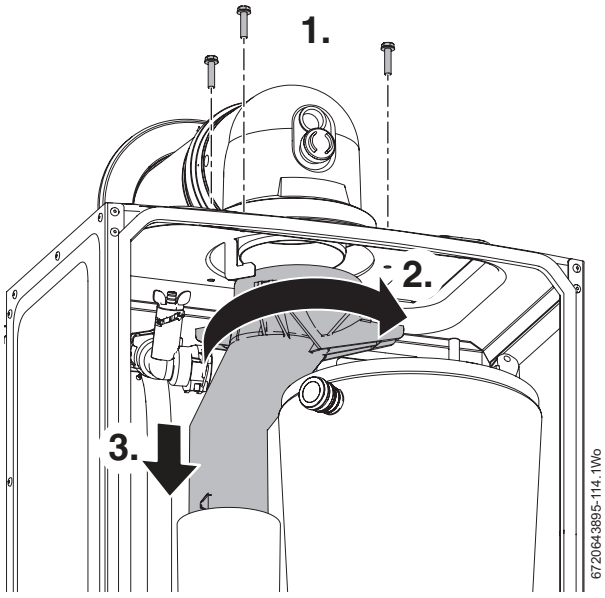


Fig. 100 Upper exhaust assembly

Refer to figure 101.

1. Release the clip.
2. Move the lower exhaust connector up

▸ Remove the complete exhaust assembly.

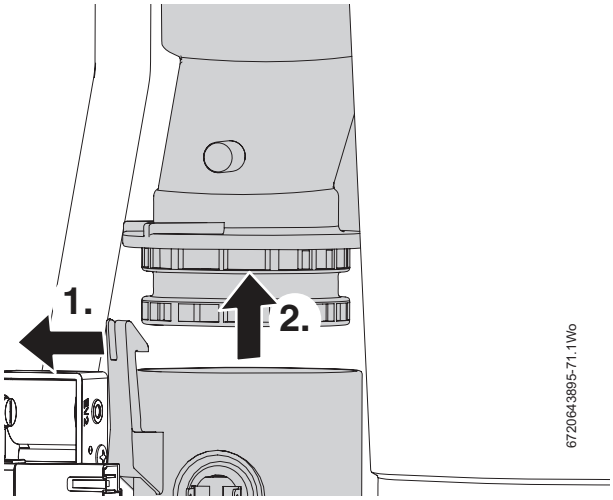


Fig. 101 Release lower exhaust connection

Refer to figure 102.

1. Unscrew the plastic nut.
2. Remove the nut from the bottom of the boiler.
3. Rotate lever to release the return pipe.

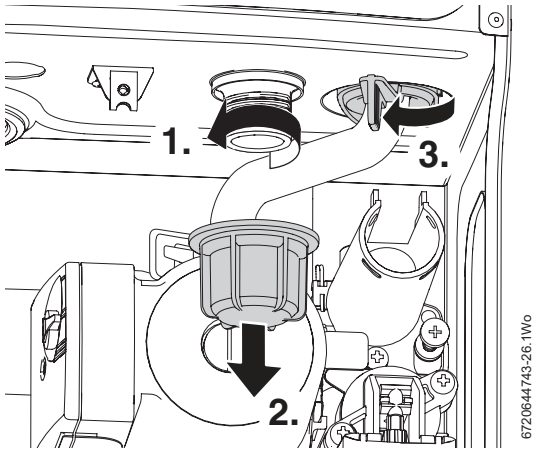


Fig. 102

Refer to figure 103.

1. Lift the heat exchanger up to clear.
2. Pull the heat exchanger forward from the case.

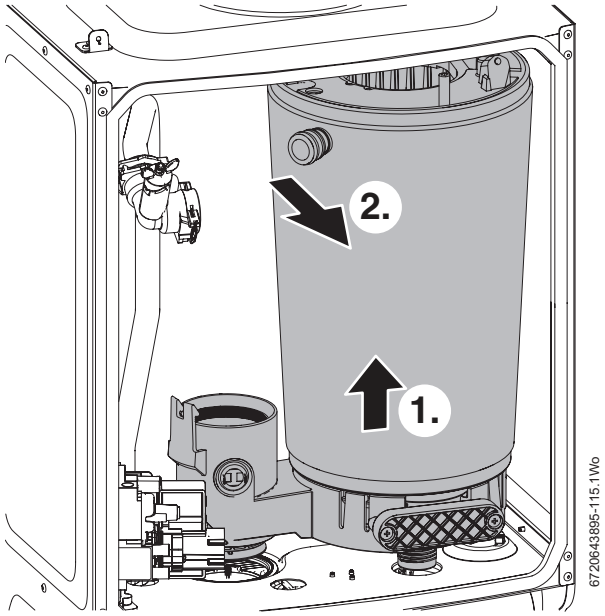


Fig. 103 Heat exchanger removal

▸ Reassemble and check combustion as stated in the gas conversion section. 6.6.

NOTICE: CO/CO_2 CHECKS

- If the joint between the Air/Gas manifold and heat exchanger is disturbed sealing gasket must be replaced.
- After completing the service of the appliance, the CO/CO_2 must be checked and set to the limits shown in “Setting the air/gas ratio” on page 46.

6.8.11 ACCESS TO BOILER CONTROL COMPONENTS

1. Remove three screws.
2. Remove cover from control.

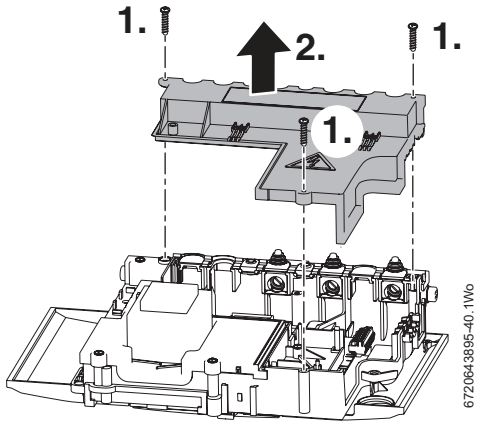


Fig. 104 Removing the connection cover

6.8.12 PCB FUSE

- Remove fuse holder with fuse F1 (1) from the PCB and replace a new fuse.

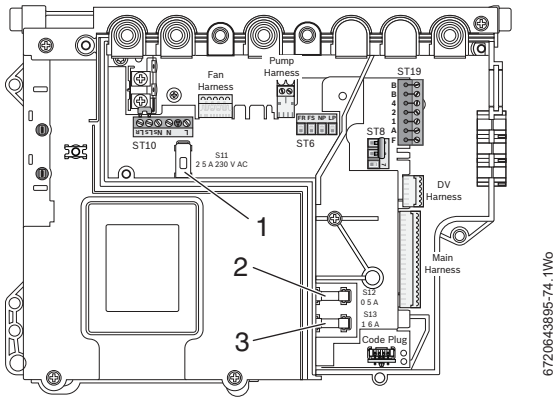


Fig. 105 Fuse locations

- Spare fuses are clipped into the underside of the electrical cover.

1. T1.6L 250V
2. T2.5H 250V
3. T500L 250V

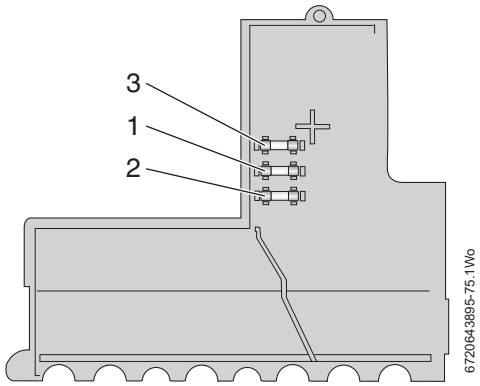


Fig. 106 Spare fuses

6.8.13 TRANSFORMER/PCB

Refer to figure 107.

- Disconnect all electrical connections from the control.

1. Remove five screws retaining the rear panel of the control.
2. Remove the rear panel.
3. Remove the transformer cover.

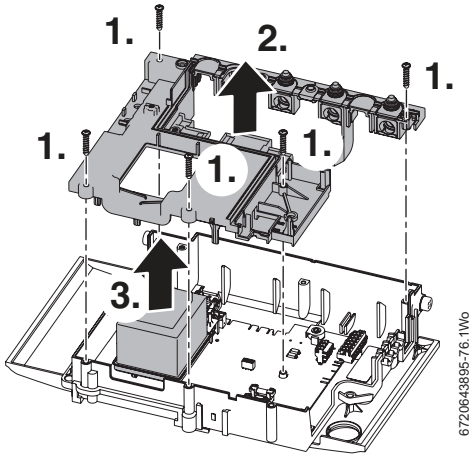


Fig. 107 Transformer/PCB access

REFITTING THE CONTROL BOARD COVER:

- Ensure that all wires are fully within the control board.
- Align the front right hand corner of the cover with the front right hand corner of the control board.
- Align the rear right hand .
- Holding the cover level, slide the cover onto the control board, ensuring that the incoming cables, at the top, are held clear.

6.8.14 REPLACING CONTROLS

NOTICE:

- Do not replace the control unit if a CO/CO_2 analyser is **NOT** available.

The control box is supplied within its plastic housing. The complete unit must be replaced.

Refer to figure 108.

1. Remove ALL electrical connections from the control PCB including where cables run through restraints. These can be unclipped from the plastic moulding noting their position.
2. Carefully remove the system pressure gauge from the fascia by parting the plastic retaining lugs securing the gauge in place. Take care not to damage or kink the capillary tube.
3. Remove the code plug . The code plug should be left attached to the frame of the boiler by its plastic safety thread.

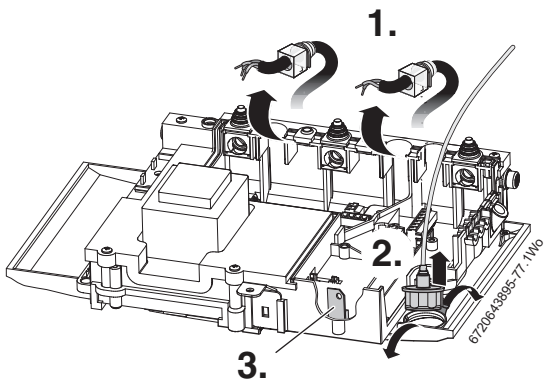


Fig. 108 Replacing the controls

Refer to figure 109.

1. Remove the three screws retaining the front fascia making sure to support the fascia when removing the last screw.
2. Remove the front fascia.

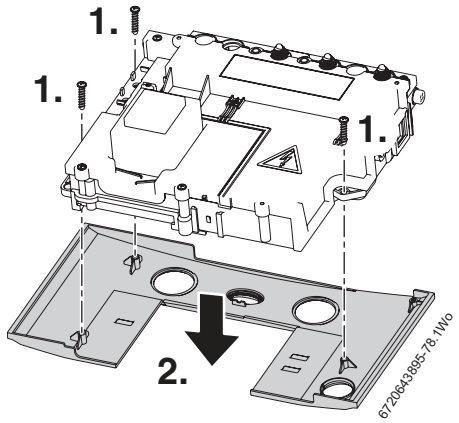


Fig. 109 Fascia removal

Refer to figure 110.

1. Using a suitable tool, press the button upwards.
2. Slide the control support bracket to the left.

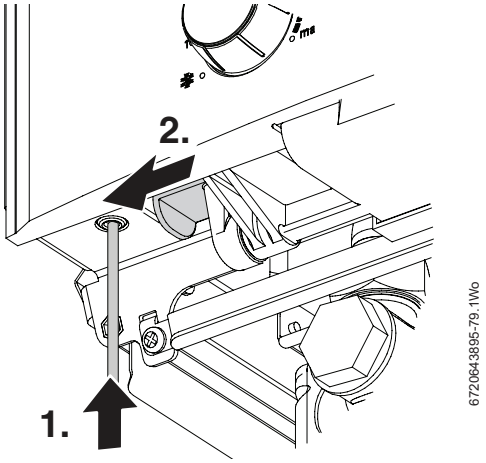


Fig. 110

Refer to figure 111.

- Support the control and unclip control support cable (1) from the boiler frame.
- Remove the support cable and fit to the new control.
- Remove appropriate cable restraints from the new control box.

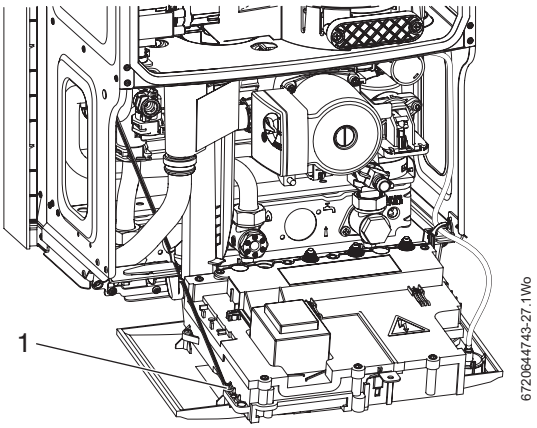


Fig. 111

- Fit control to the boiler.
- Re-connect support cable (1) to the boiler and all electrical connections and system to the new control.
- Ensure that the code plug is re-fitted to the new control. If this is not done, the boiler will indicate an error and will not function.
- Replace the fascia to the new control and secure the system pressure gauge back in the fascia .

NOTICE:

- After re-assembly, check the CO/CO_2 levels as described in section 6.6 “Air/ Gas ratio setting”.

6.8.15 SYPHON REMOVAL

Removal of the syphon assembly will give access to the Auto Air Vent.

To release the syphon from the sump:

1. Disconnect the discharge hose from the condensate outlet pipe.
2. Using a screwdriver, disengage the retaining clip on top of the syphon.
3. Pull the syphon towards you and remove the complete assembly.

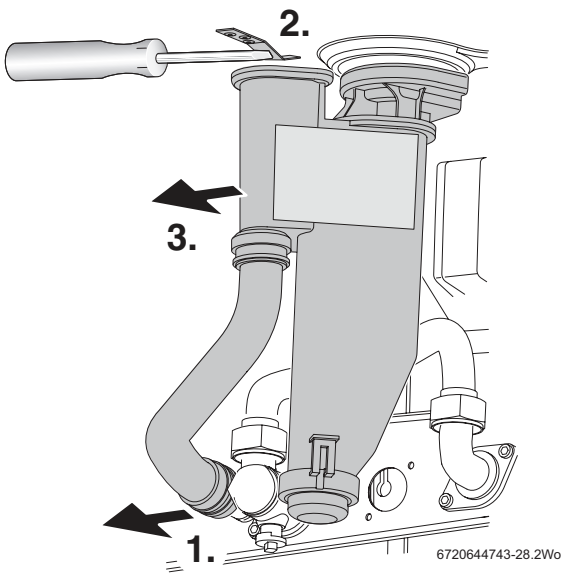


Fig. 112 Syphon removal

6.8.16 DIVERTER VALVE MOTOR (IF FITTED)

- Connect electrical power to the appliance.
- Enter the service mode to ensure that the diverter valve is in the mid position (there is no need to drain the appliance).
- Electrically isolate the appliance.
- Remove diverter valve cover, if fitted.
- Disconnect the electrical connector from the diverter valve motor.

1. Pull the motor assembly towards you.
   The assembly will slide free from the valve.

- To fit the new diverter valve motor, slide the body into the housing.
- Ensure that “H” section of the motor actuator is fitted correctly into valve body.
- Re-connect the electrical connection.
- Re-fit the protective cover (if available).

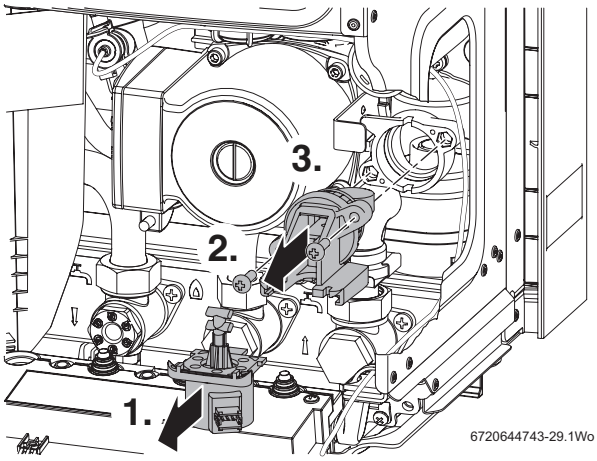


Fig. 113 Diverter valve and motor

6.8.17 DIVERTER VALVE (IF FITTED)

- Ensure the appliance has been fully drained.
- Disconnect the electrical connector from the diverter valve motor.
- Remove the diverter valve cover, if fitted.

2. Undo the two screws holding the valve to the plastic housing.
3. Withdraw the valve and clean the valve chamber if necessary.

- To refit, follow the above in reverse.
- Ensure any seals that have been disturbed are renewed.

6.8.18 AUTO AIR VENT

Removal of the syphon assembly will give access to Auto air vent. Refer to page 58.

- Ensure the appliance has been fully drained.
- Use a screwdriver or similar to rotate the air vent anticlockwise, as shown below.

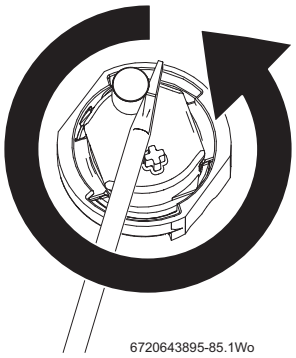


Fig. 114 Auto air vent

1. Lift the air vent (1) out of the housing and remove.

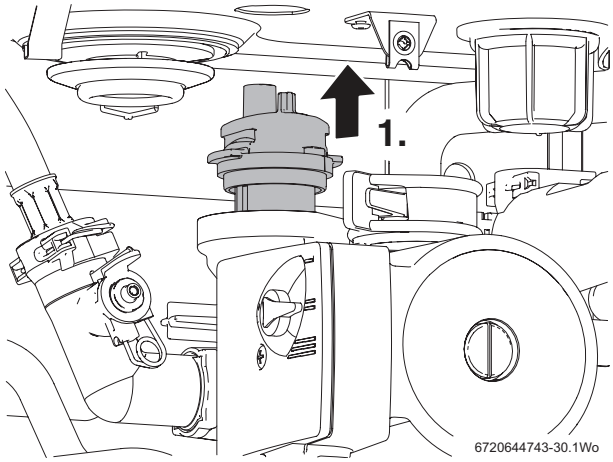


Fig. 115 Auto air vent removal

NOTICE:
- The “O” ring must be fitted to the Auto air vent and NOT the hydraulic block otherwise the Auto air vent will be difficult to fit.
- Apply silicone lubricant to the “O” ring to ease assembly.

- To refit, follow the above in reverse.

6.8.19 PUMP HEAD

- Ensure the boiler is fully drained).
- Disconnect the electrical connection from the bottom of the pump.

NOTICE: Water damage
- Protect the Control unit from water ingress when removing the Pump head.

1. Remove the four Allen bolts securing the pump at each corner.
2. Gently pull the pump towards you and remove.

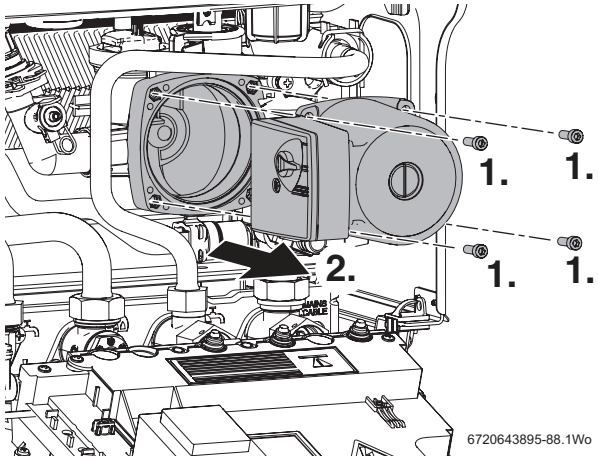


Fig. 116 Pump head removal

- To refit, follow the above in reverse.

6.8.20 DRAIN TAP

- Ensure the appliance has been fully drained.

1. Rotate the drain tap fully anticlockwise.
2. Withdraw the drain tap from its housing

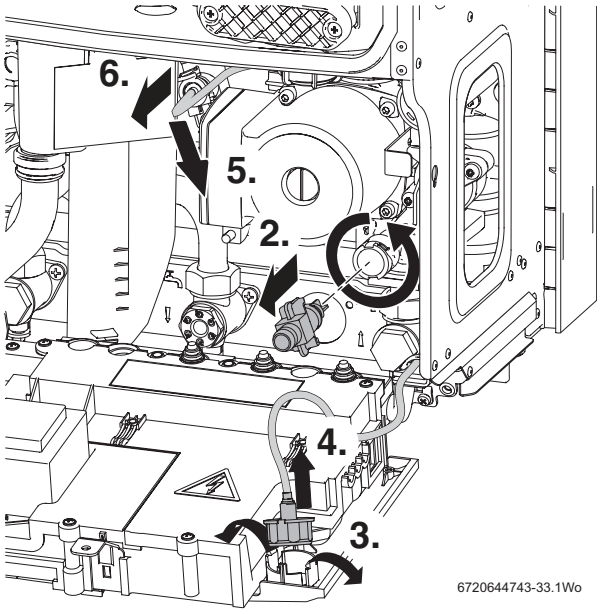


Fig. 117

- To refit, follow the above in reverse. Ensure any seals that have been disturbed are renewed.

6.8.21 PRESSURE GAUGE

- Refer to figure 117
- Ensure the appliance has been fully drained.

3. Prise the lugs apart (3) securing the pressure gauge to the fascia.
4. Remove the gauge (4) taking care not to damage or kink the capillary.
5. Withdraw the spring clip from the pressure sensing head housing.
6. Remove the pressure sensing head and pressure gauge capillary from the housing.

NOTICE: Heat damage

- Route the plastic capillary tube away from the pump to ensure that the pipe is not melted against the hot pump body.

- To refit, follow the above in reverse. DO NOT forget to fit the washer from the capillary when fitting a replacement gauge.

6.8.22 HYDRAULIC BLOCK REMOVAL

Remove the syphon assembly.
Refer to Syphon assembly removal page 58

- Ensure the appliance has been fully drained .
- Disconnect the electrical connections to the NTC sensor, turbine and pump.
- Undo the nuts securing the copper water pipes to the manifold (there is no need to remove the gas pipe).

1. Release the spring clips securing these water pipes to the plastic housing and remove the pipes.

- Release the spring clip securing the expansion vessel pipe to the plastic housing and remove the pipe.
- Release the spring clip securing the pressure gauge sensing head to the plastic housing and remove the sensing head.
- Release the locking devices that secure the two copper water pipes leading to the combustion chamber by squeezing the two tabs together and rotating anticlockwise (viewed from above).

This is not essential but makes the removal of the block easier.

- Remove the rubber pipe connecting the sump and remove the syphon.

2. Undo the two screws securing the hydraulic block to the chassis (located top left / top right of the housing).

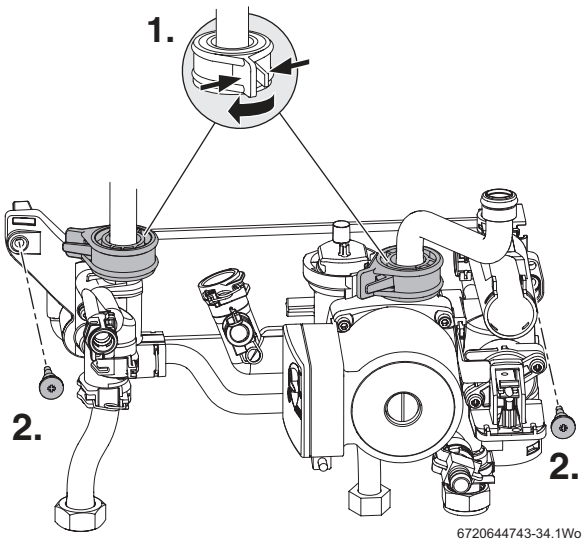


Fig. 118 Hydraulic block removal part 1

3. Lift the left hand side of the block slightly.
4. Manoeuvre the block out, starting at the right hand side.

- Take care not to snag the harness.

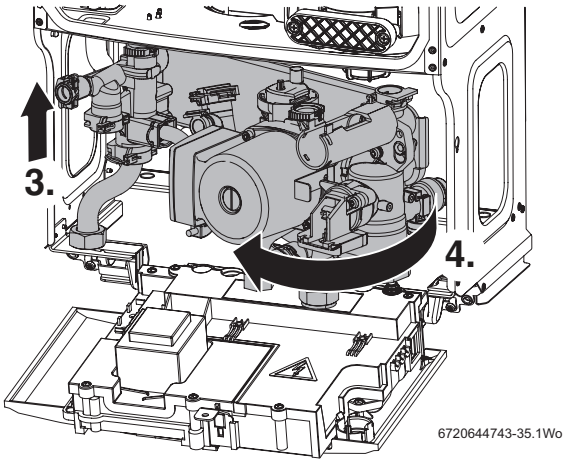


Fig. 119 Hydraulic block removal part 2

- To refit, follow the above in reverse. Ensure any seals that have been disturbed are renewed.

6.8.23 CH PRESSURE RELIEF VALVE

- Remove the hydraulic block from the boiler (See Removing the Hydraulic Block).

1. Release the spring clip from the Pressure Relief Valve housing.
2. Withdraw the Pressure Release Valve from its housing.

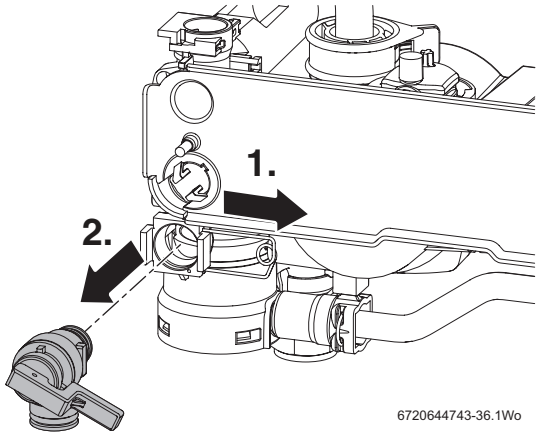


Fig. 120 PRV removal

- To refit, follow the above in reverse. Ensure any seals that have been disturbed are renewed.

6.8.24 BYPASS VALVE

1. Remove the two spring clips at either end of the copper bypass pipe.

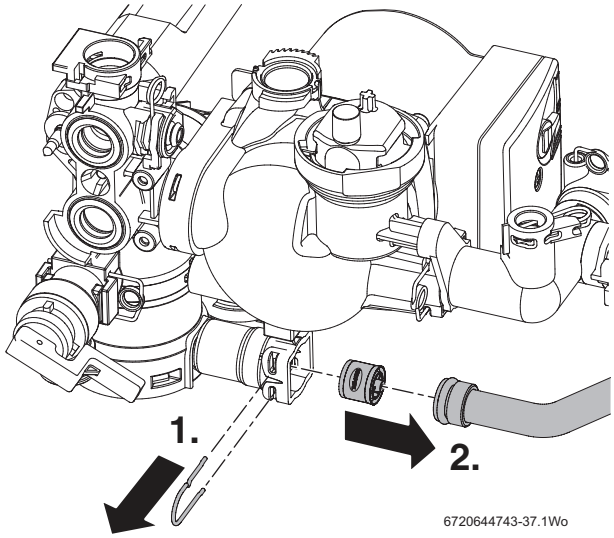


Fig. 121 Removing the bypass valve

- Undo the screw securing the left hand plastic housing to the heat exchanger.
- Move the housing to the left to free up the one end of the pipe.
- Remove the pipe from the right hand housing to reveal the bypass valve.

2. Using a pair of pliers, pull out the bypass valve from the housing

- To refit, follow the above in reverse. Ensure any seals renewed.

6.8.25 EXPANSION VESSEL

The expansion vessel can be replaced with the boiler in position if there is a side exit flue fitted and a minimum clearance of 340mm above the boiler casing. If a vertical flue is fitted then a similar clearance to one side of the flue is required.

If this clearance is not available, then the boiler will need to be removed from the mounting frame to gain access to the expansion vessel.

Alternatively a second vessel of at least the capacity of seven litres can be fitted to the return from the heating system as close as possible to the boiler.

Expansion vessel replacement (Boiler in place)

- Isolate mains power from the boiler.
- Lower the control panel to the service position.
- Isolate the boiler from the heating system (and cylinder return if internal diverter valve is fitted) using service valves.
- Drain the boiler.
- At the pump manifold, release the clip and disconnect the expansion vessel hose.

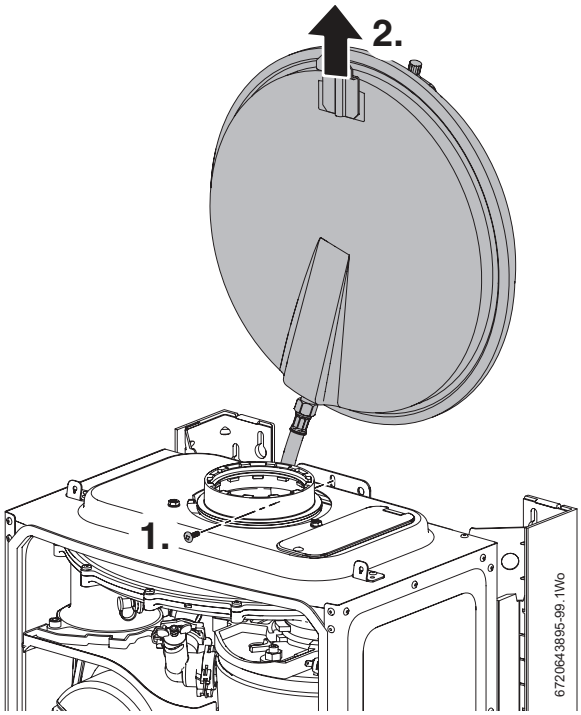


Fig. 122 Removing the expansion vessel

1. Remove screw (1) retaining the vessel to the top of the boiler casing.
2. Pull the vessel up (2) and out over the flue system or to one side if fitted with a vertical flue.

- Remove the flexible hose from the expansion vessel and fit to the replacement vessel using a new seal.
- Reassemble expansion vessel into wall frame and reconnect the flexible pipe to pump manifold and secure with the clip.

Expansion vessel replacement (Removing the Boiler)

- Isolate electrical supply.
- Isolate system and gas connections at the service valves.
- Drain the boiler.
- Disconnect electrical supply and any external controls.
- Disconnect flue connection from the boiler.
- Undo connection to boiler at the service valves.

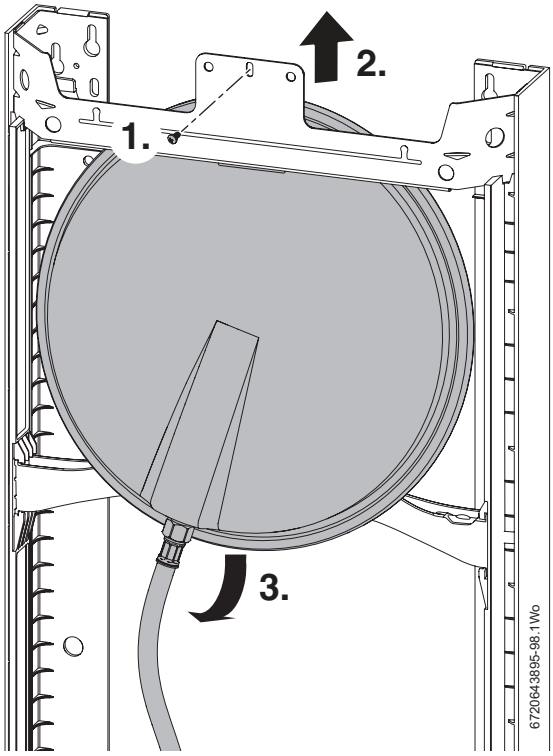


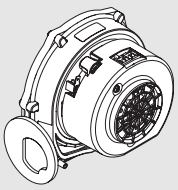
Fig. 123 Removing expansion vessel from wall frame

- Release the clip from expansion vessel connection to the pump manifold.
- Carefully lift the boiler off the mounting frame.

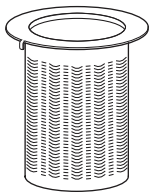
1. Remove the expansion vessel retaining screw.
2. Lift the expansion off the cross beam.
3. Pull the expansion vessel towards you to remove.

- Replace expansion vessel in the reverse order and refit the boiler to the mounting frame.
- Follow the commissioning procedure in this manual.

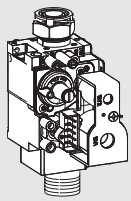
6.9 SHORT PARTS LIST



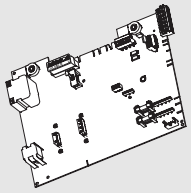
Fan
8 716 116 067 0
GC No. H26 536



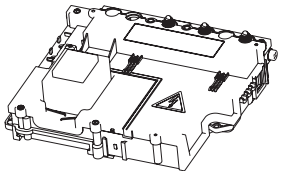
Burner
8 718 120 619 0
GC No. H26 538



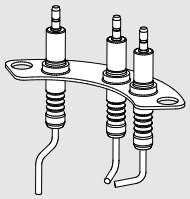
Gas Valve
8 716 111 325 0
GC No. H26 540



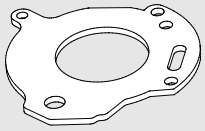
Control board
HT3 Bus enabled
8 748 300 650 0



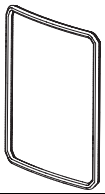
Used on:
Si & i System boilers
Control box assembly
8 717 207 937



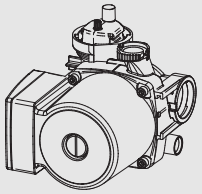
Electrodes
(including gasket)
8 718 107 087 0



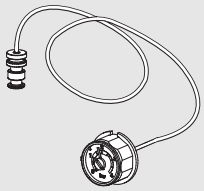
Gasket - burner
8 716 110 534 0



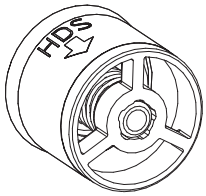
Seal - Inner case/mantel
8 716 106 635 0



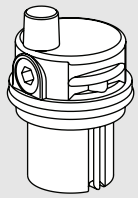
Pump assembly
3 speed
8 716 106 355 0
GC No. H02 527



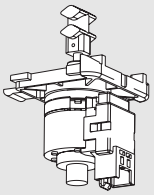
Pressure gauge
8 718 224 344 0



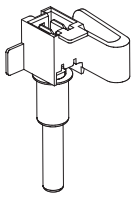
By-pass valve
8 716 106 434 0
GC No. H02 532



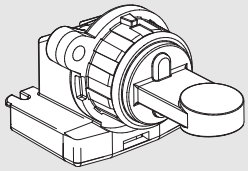
Automatic air vent
8 716 106 445 0



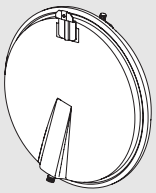
Diverter valve motor
8 716 106 847 0
GC No. H02 534



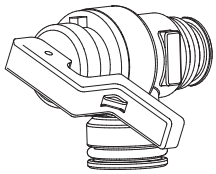
Control sensor - primary
8 716 106 688 0
GC No. H26 542



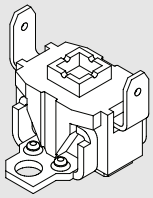
Diverter valve assembly
8 716 106 845 0 GC No. H02 533



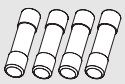
Expansion vessel
8 716 105 545 0
GC No. H05 206



Pressure relief valve
8 716 106 431 0
GC No. H09 750

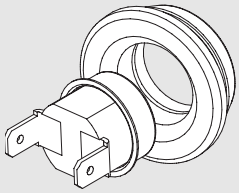


High limit stat
8 707 206 196 0
GC No. H26 584



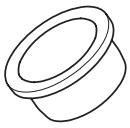
Fusing element set
8 744 503 010 0
Containing fuses:
3.15 Amp
2.5 Amp
1.6 Amp
0.5 Amp

Seals kit
8 716 107 224 0
GC No. H10 876



Flue overheat thermostat
(grommet type)
8 710 206 213 0

Flue sample plug
- vertical adapter
8 710 506 199 0

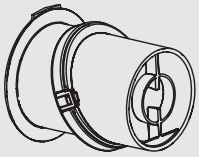


Flue sample plug
- air intake
8 716 111 253 0

Flue sample plug
- gas outlet
8 716 111 252 0

Sump gasket
8 716 113 829 0

O ring - Syphon
8 716 113 851 0



Terminal end
8 718 681 828 0

7 FAULT FINDING AND DIAGNOSIS

7.1 FAULT FINDING

This fault finding information is for guidance only. Worcester cannot be held responsible for costs incurred by persons not deemed to be competent.

The electronic control system for this boiler incorporates a blue central indicator. This normally confirms the permanent mains supply but, by flashing at different rates during a fault, provides a guide to the cause as listed.

This fault finding system assumes that the appliance has been operating normally until the time of failure (i.e. not a first installation error).

PRELIMINARY CHECKS : Preliminary electrical system checks are the first electrical checks to be carried out during a fault-finding procedure. On completion of the Service/Fault-Finding task which has required the breaking and remaking of electrical connections, check:

(a) EARTH CONTINUITY,
(b) SHORT CIRCUIT CHECK,
(c) POLARITY and
(d) RESISTANCE TO EARTH.

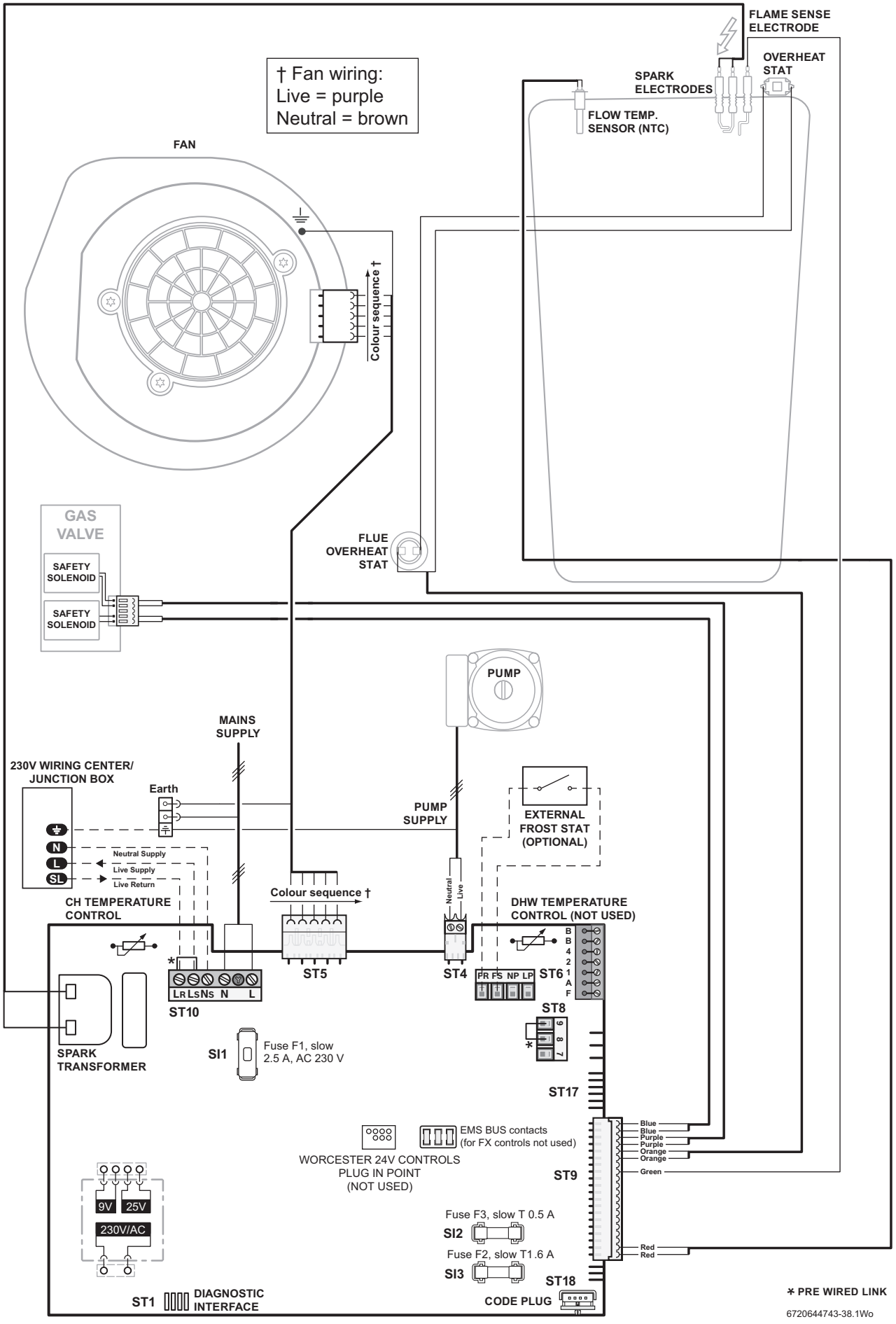
Blue light indication	Lockout reset button	Fault	Possible solution/check
Off	Off	No power at control board	Permanent mains supply to boiler. Fuse F1 - 2.5A or Fuse F3 - 0.5A. Transformer (primary coil below 60 Ω, both secondary coil below 10 Ω). Otherwise replace control board.
On	Off	Boiler not operating during central heating demand (HW ok)	Live demand at ST10-L_R (from external room thermostat/timer) Fascia mounted timer (if fitted) CH knob in winter position Diverter valve Control board
		Boiler operating without live demand at ST10-L_R (from external room thermostat timer)	Some older thermostats (containing capacitors) may give a low voltage return at ST10-L_R when the thermostat contacts are open. Check that there is no permanent live at ST10-L_R from another source.
		Boiler not operating during hot water demand (CH ok)	Ensure cold inlet DHW outlet are correctly piped i.e. are not crossed piped. If the optional Integral Diverter Valve kit has been fitted, check diverter valve and motor and control board.
		Boiler not operating during any demand.	Fan Control board

Tab. 28

Blue light indication	Lockout reset button	Fault	Possible solution/check
Slow flash (mostly off, flashes on)	Flashing (reset required)	Ignition lockout	▶ Gas present and at correct pressure? ▶ Gas valve – Check that there is 35V d.c. to each solenoid – Check the resistance of each solenoid: Top solenoid = 380 Ω ± 10% (342 - 418 Ω) Bottom solenoid = 190 Ω ± 10% (171 - 209 Ω) ▶ Combustion CO_2 level. ▶ Flue condition. – Blocked flue? ▶ Blocked condensate pipe or frozen condensate. ▶ Gas valve adjustment. ▶ Ignition electrodes/harness/connections. – Check for condition and resistance of leads (approximately 2100 Ω) ▶ Otherwise replace control board
Slow flash (mostly on, flashes off)	Flashing (reset required)	Flue overheat	▶ Heat exchanger baffles removed and not refitted.
		Heat exchanger overheat	▶ Heat exchanger blocked ▶ Water pressure ▶ All air vented ▶ Pump/harness/connections. ▶ Water leaks/blockage ▶ Safety thermostats/low voltage wiring harness/connections ▶ Otherwise replace control board
Fast flash	Off	Volatile lockout - Fan does not run	▶ Temperature sensors – Check condition and continuity of leads and resistance of sensors (approximately 2100 Ω) ▶ Fan – 230V a.c. across the live (purple) and neutral (brown) ▶ Fan lead – Check continuity ▶ Code plug – Is code plug missing or not inserted properly.
Fast flash	Flashing	Internal fault	Replace control board
2 pulses	No light	Not a fault code	Service mode selected to minimum, press service button to return to normal
5 pulses	No light	Not a fault code	Service mode selected to maximum, press service button to return to normal

Tab. 28

7.1.1 CIRCUIT DIAGRAM



7.2 BOILER FUNCTION

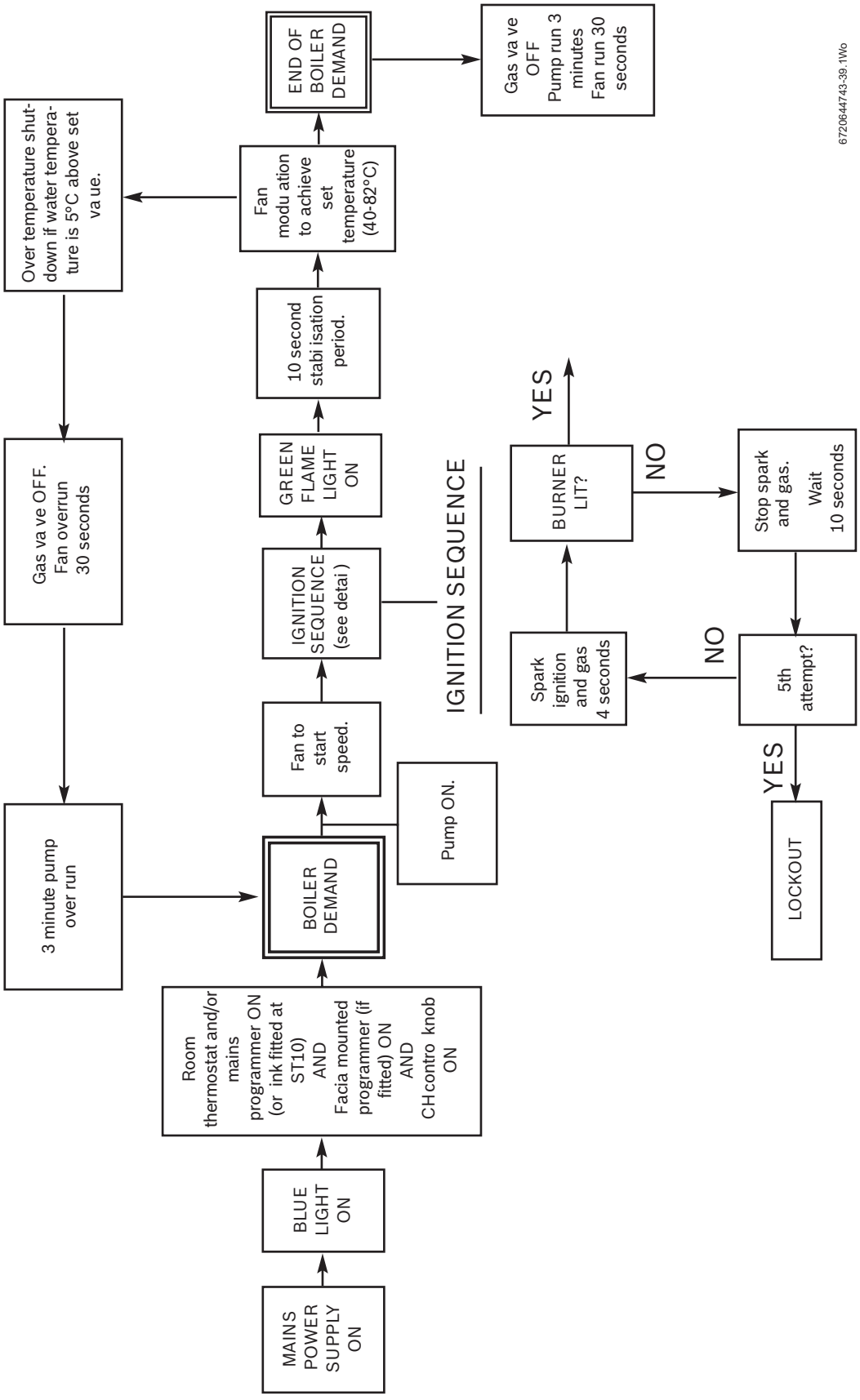
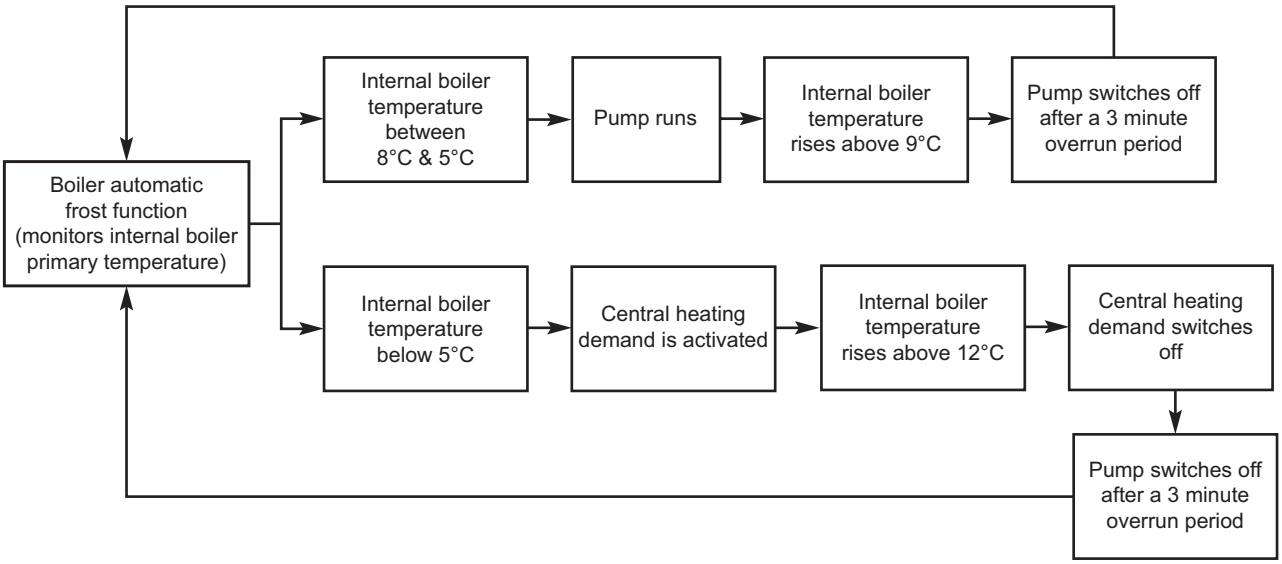

MAINS POWER SUPPLY ON
BLUE LIGHT ON
Room thermostat and/or mains programmer ON (or ink fitted at ST10) AND Facia mounted programmer (if fitted) ON AND CH contro knob ON
BOILER DEMAND
3 minute pump over run
Gas va ve OFF. Fan overrun 30 seconds
Over temperature shut-down if water tempera-ture is 5°C above set va ue.
Pump ON.
Fan to start speed.
IGNITION SEQUENCE (see detai)
GREEN FLAME LIGHT ON
10 second stabi isation period.
Fan modu ation to achieve set temperature (40-82°C)
END OF BOILER DEMAND
Gas va ve OFF Pump run 3 minutes Fan run 30 seconds
IGNITION SEQUENCE
BURNER LIT?
YES
NO
Stop spark and gas. Wait 10 seconds
Spark ignition and gas 4 seconds
5th attempt?
NO
YES
LOCKOUT
6720644743-39.1Wo

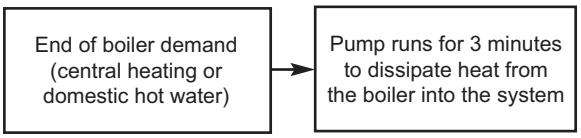
Fig. 124 Boiler function

7.3 PROTECTION FUNCTION

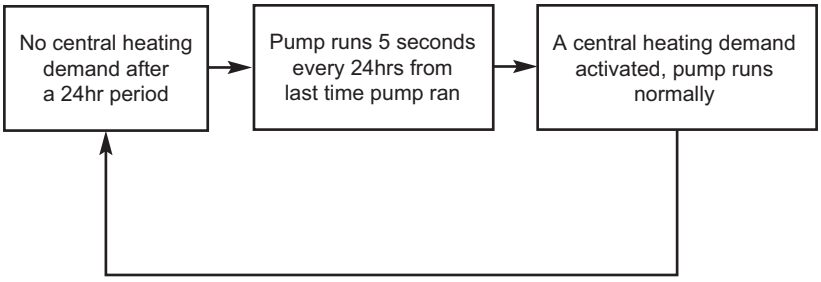
AUTOMATIC INTERNAL FROST FUNCTION


Boiler automatic frost function (monitors internal boiler primary temperature)
Internal boiler temperature between 8°C & 5°C
Pump runs
Internal boiler temperature rises above 9°C
Pump switches off after a 3 minute overrun period
Internal boiler temperature below 5°C
Central heating demand is activated
Internal boiler temperature rises above 12°C
Central heating demand switches off
Pump switches off after a 3 minute overrun period

PUMP OVERRUN FUNCTION


End of boiler demand (central heating or domestic hot water)
Pump runs for 3 minutes to dissipate heat from the boiler into the system

PUMP ANTISEIZE FUNCTION


No central heating demand after a 24hr period
Pump runs 5 seconds every 24hrs from last time pump ran
A central heating demand activated, pump runs normally

6720643895-111.1Wo

Fig. 125 Protection function

NOTES

Service Record

It is recommended that your heating system is serviced regularly and that the appropriate Service Interval Record is completed.

Service Provider
Before completing the appropriate Service Record below, please ensure you have carried out the service as described in the manufacturer's instructions.

Always use the manufacturer's specified spare part when replacing controls.

Service 1 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 2 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 3 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 4 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 5 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 6 Date:
Engineer Name:
Company Name:
Telephone No.
Operative ID No.
Comments:
Signature:

Service 7 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 8 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 9 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

Service 10 Date:
Engineer Name:
Company Name:
Telephone No.
Gas Safe Register No.
Comments:
Signature:

GAS BOILER SYSTEM COMMISSIONING CHECKLIST

This Commissioning Checklist is to be completed in full by the competent person who commissioned the boiler as a means of demonstrating compliance with the appropriate Building Regulations and then handed to the customer to keep for future reference.

Failure to install and commission according to the manufacturer's instructions and complete this Benchmark Commissioning Checklist will invalidate the warranty. This does not affect the customer's statutory rights.

Failure to install and commission this equipment to the manufacturer's instructions may invalidate the warranty but does not affect statutory rights.

Customer Name _____ Telephone Number _____

Address _____

Boiler Make and Model _____

Boiler Serial Number | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Commissioned by *(print name)* _____ Gas Safe Register Number _____

Company Name _____ Telephone Number _____

Company Address _____

_____ Commissioning Date _____

To be completed by the customer on receipt of a Building Regulations Compliance Certificate*:

Building Regulations Notification Number *(if applicable)* _____

CONTROLS Tick the appropriate boxes

Time and Temperature Control to Heating	Room Thermostat and Programmer/Timer ☐	Programmable Room Thermostat ☐	Load/Weather Compensation ☐	Optimum Start Control ☐
Time and Temperature Control to Hot Water	Cylinder Thermostat and Programmer/Timer ☐	Combination Boiler ☐
Heating Zone Valves	Fitted ☐	Not Required ☐
Hot Water Zone Valves	Fitted ☐	Not Required ☐
Thermostatic Radiator Valves	Fitted ☐	Not Required ☐
Automatic Bypass to System	Fitted ☐	Not Required ☐
Boiler Interlock		Provided ☐

ALL SYSTEMS

The system has been flushed and cleaned in accordance with BS7593 and boiler manufacturer's instructions Yes ☐

What system cleaner was used? _____

What inhibitor was used? Quantity _____ *litres*

CENTRAL HEATING MODE Measure and Record:

Gas Rate	_____ m^3/hr	OR		_____ ft^3/hr
Burner Operating Pressure (if applicable)	_____ mbar	OR	Gas Inlet Pressure	_____ mbar
Central Heating Flow Temperature				_____ °C
Central Heating Return Temperature				_____ °C

COMBINATION BOILERS ONLY

Is the installation in a hard water area (above 200ppm)? Yes ☐ No ☐

If yes, and if required by the manufacturer, has a water scale reducer been fitted? Yes ☐ No ☐

What type of scale reducer has been fitted? _____

DOMESTIC HOT WATER MODE Measure and Record:

Gas Rate	_____ m^3/hr	OR		_____ ft^3/hr
Burner Operating Pressure (at maximum rate)	_____ mbar	OR	Gas Inlet Pressure (at maximum rate)	_____ mbar
Cold Water Inlet Temperature				_____ °C
Hot water has been checked at all outlets	Yes ☐		Temperature	_____ °C
Water Flow Rate				_____ *l/min*

CONDENSING BOILERS ONLY

The condensate drain has been installed in accordance with the manufacturer's instructions and/or BS5546/BS6798 Yes ☐

If the condensate pipe terminates externally has the pipe diameter been increased and weatherproof insulation fitted? Yes ☐

ALL INSTALLATIONS

If required by the manufacturer, record the following CO_2 _____ % OR CO _____ *ppm* OR CO/CO_2 Ratio _____

The heating and hot water system complies with the appropriate Building Regulations Yes ☐

The boiler and associated products have been installed and commissioned in accordance with the manufacturer's instructions Yes ☐

The operation of the boiler and system controls have been demonstrated to and understood by the customer Yes ☐

The manufacturer's literature, including Benchmark Checklist and Service Record, has been explained and left with the customer Yes ☐

Commissioning Engineer's Signature _____

Customer's Signature _____

(To confirm satisfactory demonstration and receipt of manufacturer's literature)

*All installations in England and Wales must be notified to Local Authority Building Control (LABC) either directly or through a Competent Persons Scheme. A Building Regulations Compliance Certificate will then be issued to the customer.

benchmark COLLECTIVE MARK
THE MARK OF QUALITY FOR THE INSTALLATION, COMMISSIONING AND SERVICING OF DOMESTIC HEATING AND HOT WATER SYSTEMS

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